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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions relating to the proposed Export of Natural Gas from the Province of Alberta.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: November 7, 1950.

Volume 7.

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E R R A T A

VOLUME 5.

Page	Line	Correction
435	16	"billion" should be "million"
435	28	"signal" should be "sale"
437	22	"return" should be "residue"
434	20	Question should read:

"Perhaps I might assist Mr. Mackenzie. The last one which you just gave is this -- 90% of the going price for export in the general Leduc area; provided, however, that if any differential is established in price between gas used to supply domestic consumers within Alberta and gas supplied for export outside Alberta by any governmental authorities, then the parties shall determine by mutual agreement the percentage of the prevailing export rate per Mcf. that shall be paid by the Purchaser to Imperial."

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Exhibit

1-20 Grande Dixence Dam Situation by Imperial Oil Limited presented by Mr. Berkland.....

1-21 Great Reservoir Performance Water Level Data prepared by P & M.S. Conservation Board Engineers.....

1-22 Brief entitled "A Survey of the Supply and Western Life Lines".....

1-23 Brief entitled "An Analysis of the Reliability Characteristics of the Proposed Grande Dixence Supply for Western Life Lines".....

1-24 Brief entitled, "The Reliability Characteristics of the Gas Supplies Presently Serving Canadian Western Provinces from the Alberta and Northwestern Utilities Limited".....

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VOLUME 7.

November 7th, 1950.

MR. HAMLIN: Mr. Chairman, just before I call Mr. Pot, Mr. Mackenzie in reading over the transcript of the evidence which he gave last week found certain errata, and I have written a letter to you and a copy to the court reporter and would ask that those corrections be made in one of the succeeding transcripts by an errata sheet. Then if I could call Mr. Robert Pot, who is a petroleum reservoir engineer and our reservoir engineer. He is prepared to answer questions dealing with the matters brought out in Mr. Mackenzie's submission with reserve estimates.

MR. C.E. SMITH: These corrections, Mr. Hamlin, have you any more copies?

MR. HAMLIN: I just have a copy of the letter that I wrote to the Board. Just before Mr. Pot starts I thought we might have him file his basic data for gas estimates. I have given you copies and given one to the court reporter and that covers the fields on which Mr. Mackenzie gave reserve figures.

THE CHAIRMAN: That will be J-20.

BASIC DATA FOR GAS ESTIMATES PUT IN AND MARKED EXHIBIT J-20.

THE CHAIRMAN: Perhaps you had better have Mr. Pot discuss briefly the figures.

MR. HAMLIN: Fine.

ROBERT POT, having been first duly sworn, examined by Mr. Hamlin, testified as follows:

Q Mr. Pot, in Mr. Mackenzie's submission he gave figures for Leduc-Woodbend D-2, Leduc-Woodbend D-3, Redwater D-3, Golden Spike D-3, Excelsior D-2 and Provost. Now, you have filed as Exhibit J-20 basic data on which those estimates were calculated. Now, would you be good enough to run over for the Board the data which is shown on the exhibit, which I understand was prepared under your direction.

A That is right.

Q Now, would you start with Leduc-Woodbend D-2?

A The figure of 95.4 billion cubic feet that is reported on page 2 of Mr. Mackenzie's statement, I arrived at that by adding the production as to December 31st, 1949, to the remaining recoverable gas of 93.8, so that figure expresses the total amount of gas that we figure will be recoverable at any time anybody can see what is remaining.

Q And you assume an abandonment pressure of?

A 250 pounds. In the D-2 zone of Leduc because of the increase of viscosity oil by the expulsion, or, I should say, for the expulsion of solution gas, and that at the time the 250 pounds is reached the oil volumes and gas volumes are so small that it is not economical any more to produce the well.

Q Do you want us to go through each one and then you will have questions at the end?

THE CHAIRMAN: I think that might be better.

Robert Fot.
Dir. Ex. by Mr. Hamlin.

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ROBERT FOT, having been duly sworn, examined by Mr. Hamlin, testified as follows:

Q Mr. Fot, in Mr. Hoskovec's submission he gave figures for Lemo-Woodbend D-2, Lemo-Woodbend D-3, Rowsley E-3, Golden Spike I-3, Exploitation 1-2 and Howard. Now, you have filed as Exhibit 7-FO basic data on which those estimates were calculated. Would you be good enough to run over for the Board the data which is shown on the exhibit, which I understand was prepared under your direction.

A That is right.

Q Now, would you start with Lemo-Woodbend D-2?

A The figure of 2.4 billion cubic feet that is reported on page 8 of Mr. Hoskovec's statement, I arrived at that by multiplying production as of December 31st, 1957, so the production recorded was of 48.8, so that figure represents the total amount of gas that we figure will be recoverable at any time anybody can say what is remaining.

Q And do assume an abandonment pressure?

A 250 pounds. In the D-2 case of Lemo because of the inversion of viscosity oil by the expulsion, or, I am old say, for the expulsion of solution gas, and then at the time the 250 pounds is reached the oil volumes and gas volumes are such that it is not economical any more to produce the oil.

Q Do you mean as to go above-ground one and then you will have abandonment at the end?

A PRESIDENT: I think that might be better.

MR. HAMLIN: To go right through it?

THE CHAIRMAN: Yes.

Q MR. HAMLIN: Now, would you go through the basic data for the gas estimate of Leduc-Woodbend D-3?

A For the D-3 again we see that remaining recoverable gas as of December 31st, 1949, was 818 billion cubic feet. Produced as an estimate was 41 billion cubic feet in which is included the 35 million estimate for Atlantic No. 3. Since that is an estimate I worked it back to the original again and came out with a figure of 859 billion cubic feet. at an abandonment pressure of 100 pounds. The difference in the 250 and 100 pounds is that by the time we are down to the lower pressure in the D-3 zone we have nothing but the gas cap gas left and very good permeability, and the absence of water other than connate water that is originally in place makes it almost sure to me that we can draw that down to a substantially lower figure than the D-2. Also by that time we are far ahead in the future and I am sure we have benefited by the experience in the depletion types in the United States, that we will be able to go down to 100 pounds abandonment pressure.

Q Now, would you deal with the Redwater D-3 zone next, Mr. Pot?

A The Redwater D-3 is a reservoir in which the oil is undersaturated and it is always difficult to say what is going to happen but we can say what we hope and that is that we can keep the pressure above saturation pressure so that our gas-oil ratios won't change. They are only dependent on separator pressure that we separate our oil and gas at

at the surface, so the estimate for that I based on the estimated recoverable oil, stock tank oil, combined with 200 cubic feet per barrel of stock tank oil through a 10-pound separator. Then a tentative, and I would like to impress that, tentative, is nothing else but the oil recovery times the constant gas-oil ratio. If we estimate that because of differences in separator pressure and other unforeseen circumstances, 15% is not gathered. I come to remaining gas reserves at the 31st December, 1949, of 81.6 billion. We had a production of 300 million added to that remaining and it gives me a figure of 82.3 billion cubic feet of gas which is available during the production of oil. Of course, we have gas left in the reservoir then and we could come to a little different calculation where if we take the oil in place and the oil recovered, the oil left in the reservoir is in the order of 726 barrels. We figure with the high viscosity oil we have there an abandonment pressure of 300 pounds. Then we can get another 41 cubic feet per barrel of stock tank oil, the oil in the reservoir. You won't find that anywhere, this is just ad libitum. . So there would be an extra production there of almost 30 billion cubic feet, saturation pressure to 300 pounds. I just wanted to mention this because there are so many different ways you can look at these reservoirs. It all depends on the way it eventually will be produced.

Q Would you deal with Golden Spike D-3?

A Golden Spike D-3 is being done in a similar way and here the ultimate recovery in barrels of stock tank oil is

estimated at 70 million barrels. The gas-oil ratio is approximately 400 cubic feet of gas per barrel of stock tank oil through a 50-pound separator. So here again, multiplying the stock tank oil with the gas-oil ratio we arrive at a figure of 28 billion cubic feet which can be produced at the same time as the oil is produced, all the time staying above saturation pressure. Here is the hope again that we will be able to inject water or gas or we have a natural water drive. We do not know that yet but the hope is there that we can keep that reservoir above saturation pressure, there again following the best engineering principles as we know them.

Q Now, would you deal with Excelsior D-2?

A Excelsior is the same type of reservoir, under-saturated oil. We have estimated oil recovery there of 11 million barrels of stock tank oil with the gas-oil ratio through a 10-pound separator of 230 cubic feet of gas per barrel of stock tank oil. Multiplying those two figures we come to 2½ billion cubic feet. Estimated 15% not gathered leaves 2.1 million cubic feet.

Q Now, you have dealt with the reserves which were covered under the heading of "Solution Gas and Gas Cap Gas Associated with Crude Reservoirs". Would you now deal with the one dry gas reserve of which we gave an estimate, namely, Provost?

A The Provost Field, we have already handled that at one time when we gave our submission to the Dinning Commission two years ago and we have not changed any of our figures since that time. Although there may have been insinuations

that we have changed our thinking on it, that has not happened as far as I am aware of the fact, so we still carry our 85 square miles of area and we come to a calculated reserve in billions of cubic feet in place expressed at 14.4 pounds and 60 degrees Fahrenheit, 123 billion with that to an abandonment pressure of 100 pounds is 110, to reservoir pressure of 200 pounds is 97 billion cubic feet of gas.

MR. HAMLIN: Mr. Chairman, that is the only evidence I intend to put in through Mr. Pot. If anybody wishes to cross-examine him.

CROSS-EXAMINATION BY MR. STEER:

Q I do not quite understand your reference, Mr. Pot, to under-saturated oil. What is that?

A Under-saturated oil is a term we use when we have oil in the reservoir that is at a reservoir pressure that is higher than the saturation pressure of that oil itself. An under-saturation pressure, I mean the pressure at the reservoir at which for the first time gas will come to solution. As an example, I would like to take Redwater. We had 105 p.s.i.g. Originally pressure, well saturation pressure, at 94 degrees Fahrenheit was only 485p.s.i.g., so above that pressure of 485 we have the extra pressure up to 1050, and as long as we keep that compression on there and do not increase the compression in the reservoir, to or below 485 we will not have any solution gas come out in excess of what we have with 1 barrel of stock tank oil.

Robert Pot,
Cr. Ex. by Mr. Steer.

Q Now, Mr. Mackenzie in his statement the other day, at the bottom of page 5 and the top of page 6, gave an estimate that over 25 years - - have you that in front of you?

A Yes, I have, sir.

Q Over 25 years the gas to be delivered from the Leduc field to market would be 180 billion cubic feet. Is that correct?

A Yes, that is the figure Mr. Mackenzie gave.

(Go to page 581)

Q And is that your figure?

A No, it is not my figure. My figure is 310 MMCF since I only dealt with the reserves.

Q I see?

A And I did not give a figure.

Q Your figure then is the 310 that you have at the bottom of Page 5?

A Yes, 310.

Q And Mr. Mackenzie has made an estimate as to field use, plant fuel and waste, and he gets a figure of 180?

A That is correct.

Q Now, that is all the gas that is to be delivered to market from the Leduc field according to Mr. Mackenzie's estimate for the next 25 years?

A That is the way I read it.

Q That is way you read it?

A Yes.

Q And, as I figure that, that is an average of 7.2 billion per year, or roughly 20 million cubic feet per day?

A Yes, the slide rule says that is right.

Q Now, have you seen some figures that were prepared by the Imperial Oil Company and sent to the Gas Company with regard to the estimated residue gas available over the years '51 and '52?

MR.HAMLIN: Mr. Chairman, Mr. Pot was called as a witness to deal only with the manner in which we calculated our reserves and to substantiate the reserve figures that were given by Mr. Mackenzie. Now, he is not qualified to deal with matters of deliverability from the gasoline plant or deliverability from the field to the

gasoline plant, and I would ask that he not be asked these questions, or, if he is, I will instruct him not to answer.

THE CHAIRMAN: Mr.Hamlin, how did Mr. Pot arrive at this figure of 310 billion feet if he had not some idea?

A I can give you that.

MR. HAMLIN: Mr. Pot can answer that.

Q If you will take the -3 zone, we have 859 billion, as I said, that we had here as a reserve, and we also have about 600 billion in the gas cap. The difference there is 259 billion cubic feet. The D-2 zone has 93.8, or, let us say 94. When we add these two together we get 353 billion cubic feet. We have produced up to now about 44 billion cubic feet, and deduct that from the 353, and we get 310 billion cubic feet. That is how I arrive at it.

THE CHAIRMAN: Mr. Hamlin, when Mr. Mackenzie spoke the other day, gave evidence, I asked him if Mr. Pot would be able to discuss the reservoir engineering of the various domes, and in connection with that could indicate to us how long it would take to produce the oil.

MR.HAMLIN: Are you talking of the daily withdrawals?

THE CHAIRMAN: To get this figure of 310 billion over a period of 25 years, he must have considered the reservoir engineering and how the oil should be withdrawn?

MR.HAMLIN: I was going to ask Mr. Pot this question. I was going to ask Mr. Pot the question that

was asked Mr. Mackenzie, and I believe Mr. Pot has that answer, is able to answer it. The question was,on Page 441 of the transcript,

> "I do not suppose you have anything to show us what your anticipated withdrawals are, daily withdrawals, as compared with Mr.Dixon's? You have not had that tabulated?"

And the answer was,-

> "No, possibly Mr. Pot could give you some quick figures from notes he has."

Is that what you had in mind, Mr. Chairman?

THE CHAIRMAN: I think possibly that is in line with the questions Mr.Steer wanted to ask, I do not know, but I think it is dealing with the question of the production of gas and engineering.

MR.HAMLIN: I think the letter which Mr. Steer was showing Mr. Pot dealt with deliverability from the gasoline plant, and involved the operation of the gasoline plant and what it can deliver.

THE CHAIRMAN: Well, we will not allow any questions like that, but Mr. Pot will be able to answer the questions as to the gross gas production.

MR.HAMLIN: Yes. If you would like, I can ask him that question now.

THE CHAIRMAN: Yes.

Q MR. HAMLIN: Mr. Pot, you have some notes or figures which would indicate what your anticipated withdrawals would be from the Leduc-Woodbend field by daily periods?

A Yes, I have some figures here, and I would like to say

that I have got them by years, and I have got them by three-year periods.

Q Well, perhaps.....

MR. STEER: I wonder, Mr. Chairman, if my learned friend will pardon me?

MR.HAMLIN: Yes.

MR. STEER: In order to determine what the capacity was of the Northwestern Utilities' plant, of the Northwestern Utilities' City of Edmonton system, to take gas from Leduc-Woodbend, certain inquiries were made of Imperial Oil, and we have a letter from Mr.Colpitts, Management Assistant, in which he says, "We agreed that we would supply our estimated volumes of gas available for the same period," - that is up to the end of 1952 - "after we had made our first studies of plant operation. This information is attached hereto in tabular form." And the Table that is attached gives the residue available MCF per day, and it is headed, the original is headed, "Comparison of Gas Available from Leduc Field", rather, I beg your pardon, "Comparison of Gas Available and Gas Requirements of Northwest Utilities", and those are the questions which I was proposing to pursue with Mr. Pot.

THE CHAIRMAN: Well, I understand Mr. Pot is not qualified to say what the residue gas available from the conservation plant and the absorption plant is.

MR. STEER: I take it we have that evidence?

THE CHAIRMAN: I beg your pardon?

MR. STEER: I take it we have that evidence, that there is 24 million per day, and I had no notion of asking Mr. Pot anything as to that. All I wanted to do

was to verify these figures which we got from his company.

THE CHAIRMAN: But that would be after the processing of the gas? As I understand, Mr. Pot is qualified to let us know the gross amount of gas production in the field, but he is not qualified to indicate what would be the residue after processing.

MR. STEER: Then may I request my friend if he will call Mr. Colpitts, who, perhaps, is the man we should have here to get the information.

MR. HAMLIN: Well, I was going to cover the figures which you have there, and I believe they were prepared in part from an estimate which Dr. Govier asked Mr. Mackenzie to produce for the Board, and which Mr. Mackenzie said he would, and that was an estimate of the over-all ratio between gas available for disposition and raw gas put into the line, that is, after the residue gas was available, having gone through the plant, and I think that Mr. Mackenzie said we had prepared such an estimate based on production in the last half of 1951.

MR. STEER: 1950?

MR. HAMLIN: 1951. And Mr. Mackenzie said we would be prepared to produce that. Now, we are in the process of bringing that up to date It was prepared in August of this year, and we are bringing it up to date up to October, and we propose to file that, and I believe you will then have before the Board the information which you wish to get through this witness.

THE CHAIRMAN: When will you file that?

MR. HAMLIN: I hope to be able to file it this week, Mr. Chairman. Perhaps you could read to the

witness the question that I asked.

THE CHAIRMAN: I think if you will proceed to give us the gas production as he sees it.

MR.HAMLIN: All right.

A The total gas production from the D-2 and D-3 in MMCF daily, the way we see it, is that in 1950 we will have 21.7, '51, 25.1, '52, 26.0, '53, 30.3, and then the next years I won't read but I will give you the gas, 34.8, 40.9, 47.3, 52.2, 56.1,65.7, 67.1, 66.4, 65.2, 63.7, 62.5, 60.0, 58.5, 57.0, 55.9, 54.8, and 53.1 until we reach 1970. I have not gone farther.

.....

CROSS-EXAMINATION BY MR. NOLAN:

Q I wonder if Mr. Pot would tell us now what allowables he is figuring on in connection with these figures?

A You mean oil allowables?

Q Yes? What is your present allowable?

A The allowable right now is for the D-2, 70 barrels, and for the D-3, 110 barrels.

Q Now, are you using a higher or lower figure?

A A lower figure, definitely, because this is the maximum that we are allowed to produce. The figure I stated to you is the maximum we are allowed to produce. Now, if all the fields that we have next to and above our D-2 and D-3 in Leduc, if they were to over-produce their allowables we would have far too much oil. Now, we have only a certain market outlet, and we have to shrink all these figures, and we get prorated figures which I have taken into account.

Q What are they producing now?

A I looked at the August figures, and those are the last figures that we have for the total industry, and we are producing 8,700, around there, for the D-2, that is August figures, and 12½ thousand for the D-3.

Q But, as I understand you, Mr. Pot, it will be necessary to cut down on the oil production below the present allowable?

A Yes, it will. We have a little leeway right now because we have to fill the pipe line, and so it is above our ordinary daily average acceptable.

Q So that there will be an increase?

A Well, right now we are in a little increase, but it sure will reduce again as soon as we have the pipe line filled.

Q Thank you, Mr. Pot.

.....

CROSS-EXAMINATION BY MR. S.B. SMITH:

Q Mr. Pot, do you foresee the possibility at all of gas from any source being used for repressuring purposes in Excelsior, Golden Spike and Redwater?

A I would like to take them in the order that you gave them there.

Q Yes?

A Excelsior, no. Excelsior is the type of reservoir, the same as the Leduc D-2, rather poor over-all permeability, and not exactly the type of field you would desire for gas injection other than flooding, and in flooding I expect the movement goes in a lateral direction. The lateral direction is all right if you own the field entirely;

if you do not own it entirely you are apt to get into the darndest legal business unless you have unitization. Besides, there is quite a good indication of water drive in Excelsior, so that we hope that Mother Nature will supply us with the extra energy.

The other one was Golden Spike, that you wanted.Golden Spike, so far the history of it, there is a slight indication of - or let me change that. There is an indication of a light water influx and that may definitely increase. We do not know yet. We need a little longer time to study the actual pressure decline. But if there is not a satisfactory water drive to keep that pressure above our saturation pressure, in the reservoir, we either will have to inject water or inject gas. Now, we haven't studied yet which one of the two is the better, because gas is fine but it does not actually push all the oil ahead of it. It breaks through at a certain time, although aided with the gravitational effect of the oil coming down in the high reservoir, it might be satisfactory. While the water, whenever we drive oil up,it is against the gravitational effect, we have a water plug movement then we can control our production better, and we can expect a high recovery, so that we have not studied that definitely yet, and we hope to get that in the very near future, before we have reached the saturation pressure.

Q Is it at this stage possible for you to predict at all to what extent you might use gas there, if you decide to use gas for this purpose?

A Well, it still hinges around that water drive.

Q I see.

A In a field where you haven't got the water drive, to use solution gas is not satisfactory to keep your pressure up. You have always to supply an extra source, so that will have to come from somewhere, while if we have a slight water drive we might just be able to re-inject solution gas and keep it at a pressure satisfactory for the time being. It might have a slight drop, but it might not be a fast one, and we would have it there for the time being, and at a later date we could see what we had, and whether we should inject more water or inject more gas.

Q Is it possible for you at all at this stage to predict how much gas you would use for that purpose? Perhaps it is impossible at this stage?

A Like I am sitting here, yes, it is impossible.

Q It is impossible?

A Yes.

Q And did you deal with Redwater?

A Not yet. That was the third on the list?

Q Yes?

A Redwater has a definite water drive, and we are not intending to inject any gas in that field.

Q All right, thank you.

.....

CROSS-EXAMINATION BY MR. M DONALD:

Q Just one question, Mr. Pot, with regard to the Excelsior field, your estimate is based upon the acreage controlled by the Imperial Oil Company?

A No, it is the entire acreage.

Q It is the entire acr age of the area.

A Yes, Mr. McDonald.

Q All right, thank you.

.....

EXAMINATION BY MR. C. E. SMITH:

Q Mr. Pot,have you seen Mr. Dixon's Table in Exhibit J-13 following Page 8? You will remember I asked Mr. Mackenzie some questions about it?

A Yes, I have seen it.

Q And as a layman, probably you can explain to me the difference in Mr.Dixon's daily gas production from D-2 and D-3 as distinguished from the figures you have just given us here? For instance, 1957, I mentioned to Mr. Mackenzie, he has a total of 80.1, and what would your total be there?

A I would like to split it into two zones, if you do not mind?

Q It is split here in two?

A 1957, daily gas production, 31.5.

Q That is D-2, is it?

A D-2, yes, sir.

Q Yes?

A 1957, 14.6.

(Go to Page 591).

Q And the D-3 for the same period?

A The D-3, 1957, 48.6 versus 36.6.

Q Yes?

Q DR. GOVIER: And what was your D-2 figure?

A 14.6.

Q MR. C. E. SMITH: Could you give me an explanation of the difference in the two sets of figures, Dr. Pot?

A The main difference as far as I can see it is that in the tabulation in the report you mention you have assumed 10,000 barrels per day withdrawal from the D-2 constant from 1952 to 1959, which we definitely do not predict

Q Why not ?

A Because we will not have that high acceptable from that field.

Q By that you mean you do not anticipate a market?

A That is right, sir. We do not anticipate a market to keep up with new discover s and with drilling in those fields.

Q According to what we read in the papers lately, you might have a market for everything you have got?

A There again I want to caution you that what Mr. Mackenzie said, that all these figures are just oil production and if somebody said that we are going to have a war and you are going to produce all these fields and the like of that --

Q Does your idea of future oil production depend entirely on the market question?

A Yes, it entirely does.

Q It does not depend on Board allowables?

A No, it does not.

Q And your figures possibly are different from Mr. Dixon's

for that reason, that you do not anticipate the amount of oil marketable in the future that he apparently does?

A That is right. That is one of the main differences.

Q And one other thing that I mentioned to Mr. Mackenzie, and that was the question of gas/oil ratio, and his figure which rose from about three to four times, I think, in practically 10 years?

A You are looking at the D-2 or the D-3?

Q The D-3 particularly?

A The increase in this Table is from 720 to as high as 2600 in 1962.

Q Yes?

A The gas/oil ratio that I have used is 750 to as high as 3350 in 1970 and still increasing.

Q 3350 in 1970 and still increasing?

A Yes, sir, still increasing from the year before, it was 3300 and it is now 3350.

Q And what is your corresponding figure for his 2600, is that your 3350?

A No, I have got 1850 because of slower withdrawal.

Q As he explained, I think.

A We do not get our gas saturation as high as it is taken in this report you are stating.

Q Did you hear Dr. Dixon yesterday?

A No, I did not.

Q I think he indicated the same thing, that was the principal difference?

A Surely.

Q The rate of withdrawal?

A Usually you have a gas/oil ratio curve versus at the accumulative recovery from the reservoir as a percentage of the stock tank oil in place. You will see, if you withdraw it faster, you will very quickly notice a higher gas/oil ratio curve.

Q And apparently we get back to what you said before that the primary difference is the question of the rate of withdrawal?

A Yes, that is the primary question.

Q And insofar as the difference between your figures and his are concerned. The amount of oil produced, you anticipate the amount of oil produced in future much less than he does?

A Yes, that is one of the main points. There are a few minor items which I do not actually agree with but they are such things that engineers like to come to a blackboard and beat each other over the head with. For instance, I do not agree with the low permeability in the D-3 that has been mentioned in this report of Mr. Dixon's and the report of Dr. Brokaw.

Q You do not agree with the low permeability?

A Not in the D-3.

Q They might be glad to hear that?

A We have core analyses which indicate a lot more permeability. On top of that we had a blowout at Atlantic, which gave tremendous amounts of oil and in trying to flood that well out we pumped water into that reservoir at a terrifically high rate, as high as 40,000 barrels a day. We had high

pump pressures. I think it is a good permeable reservoir.

Q As a matter of fact, I believe you pumped in everything there but the kitchen sink?

A Yes.

Q Wherever it went, I do not know. Can you give me some idea of the rate of increase in the gas/oil ratio in the D-3 during past year, say?

A During the past years, during the history of the field?

Q The past year, say from July 1949 to July 1950?

A I have the gas/oil ratio for August of this year which for the D-3 amounted to - -

THE CHAIRMAN: Mr. Smith, I think you have a chart there, prepared by the Board.

THE WITNESS: - - 570 cubic feet.

THE CHAIRMAN: I think it would be better to distribute this. It may facilitate matters.

MR. C. E. SMITH: I was going to show it to the Doctor, Mr. Chairman, probably before I distribute it, because he might agree with what is on it.

Q Are you pretty familiar with this? It is headed "Reservoir performance - Leduc D-3 Zone." And particularly the centre line that is giving the gas/oil ratio.

THE CHAIRMAN: We will give that an exhibit number.

CHART "RESERVOIR PERFORMANCE LEDUC D-3 ZONE" NOW MARKED EXHIBIT J-21.

THE CHAIRMAN: I think you might just pass some of these around, Mr. Smith. I think Mr. Dixon might like to see the chart. I may say that information has been

made public some time ago. We prepared this reservoir study before any oil hearing. We felt it might be useful.

Q MR. C. E. SMITH: Have you seen this before?

A Yes, I have seen it before.

Q In your opinion does it correctly give the information it purports to give there?

A I looked at the gas/oil ratio and it looks like that is all right. I just called a figure of 570 for August 1950. We have 550 here.

Q DR. GOVIER: 560.

A 560. We do not look at 10 cubic feet if it comes to gas measurement.

Q MR. C. E. SMITH: All I want to draw to your attention at the moment is it appears that from about August to August, that is 1949 to 1950, that line runs fairly level all through that, as far as the gas/oil ratio is concerned?

A Yes, it does.

Q It would hardly be correct to say it has increased in any event during the past year? It might be slightly lower. Do you anticipate any great change, in say the next year or the next two or three years?

A No, sir.

Q From what is disclosed there?

A We do not anticipate any great change for the next year or the year after that.

Q When would you expect any considerable increase?

A It will be a gradual increase if we can keep the gas cap from breaking through the oil and being a good operating company we will try to do so.

Q Mr. Mackenzie mentioned that in his submission. All that I am trying to get at is has that any significance, that line that indicates a level performance with respect to the gas/oil ratio during the past year?

A No, sir, it is quite a natural thing that does happen. Our pressure in the D-3 reservoir during the last two years has only dropped 19 pounds from 1825 to 1806 and I am using my own figures now.

Q Now I understood Mr. Dixon to say yesterday during some study he made of the Board's data he got the impression even now that the gas/oil ratio was increasing to a very considerable extent. You do not think that is right? Now is this an exhibit, sir?

THE CHAIRMAN: Yes, exhibit J-21.

Q MR. C. E. SMITH: J-21 does not indicate that?

A No, it should not increase. As I say, the pressure does not drop enough so why should the solution oil/gas ratio increase?

Q As long as you can maintain that condition?

A Where we do not break through the gas and why should we break through the gas when we are not producing at higher rates than we used to do and we are not producing enough to change the gas/oil contact considerably.

Q I think that is all I want to ask you. Some of the rest may want to ask you something about this.

A I would like to add to this, to your request, that another difference with the Brokaw report is that we have a definite water drive in the D-3.

Q You are convinced of that, are you?

A Convinced of that, sir. As I say, we had a cumulative production and now I take the period right after Atlantic so we have not any guesses in there - we got 14 million barrels of stock tank oil, that is up to August 31, 1950, taking a three year period and the pressure dropped 19 pounds in that time. During that time the water influx has been 10 million barrels of water, so there is a definite water drive in that reservoir which will tend to keep your pressure higher and less gas breaks through and at the same time keeps your oil pushed up against your gas and you will not get a lowering of the gas/oil contact and with less possibility of a gas break-through.

Q I take it your own opinion of an effective water drive is a little more firm than Mr. Mackenzie's?

A Yes. He did not date to quote figures because I had them all.

Q He did not seem nearly as definite as you are. Thank you for reminding me of that. I mean, reminding us of the effective water drive.

EXAMINATION BY DR. GOVIER:

Q I am rather intrigued with one of the figures you present in Exhibit J-20. On the first page you give estimated recovery 22.2%. How did you get that figure?

A That .2% slipped in there because it was not any use to

work with a figure of 99.5 barrels of stock tank oil recovered per acre foot. I like to use 100. So somebody figured that there was a recovery of 22.2%. It is rather an insignificant figure, the second one. Even the 22% we do not know. It is our guess.

Q How far in either direction might that figure be out?

A For a pure solution-gas-drive field, where no water drive, we have not found very high recoveries above 25% as a maximum. Usually it is more than 22%. The experience figures of the older fields we always will say it is 17 or 19. Of course, we are going ahead. Engineering practices are getting better all the time. There are good companies in Canada so we can expect good engineering practice from them and I hope we definitely will get at least as high a recovery as I have indicated here.

Q Mr. Pot, I am sure you are familiar with the little book issued a few years ago by the Affiliated Jersey Companies, "Reservoir engineering for the layman" or some such thing. Do you recall the little book I refer to?

A Yes, we called it the Blue and Red Bible.

Q The Blue and Red Bible. My recollection is that that book suggests that in a solution-gas drive, recoveries of the order of 20 to 40% should ordinarily be expected. Do you care to comment on that?

A My only comment may be I do not remember seeing that figure.

Q I guess that is as far as we can go then.

MR. C. E. SMITH: Is this book really for the layman, Dr. Govier, that you refer to?

DR. GOVIER: As far as I know it is.

Q Mr. Pot, the estimate you present for the D-2 remaining recoverable gas, am I right in assuming that that is gas which goes also to the intake of the gathering system and to the plant?

A Absolutely right, sir. If we had pipe lines to all these wells.

Q So the 15% you have deducted does not include a deduction for wells which are not connected?

A I may have had in the back of my mind something of that sort. I said "stock tank vapours, etc."

Q Yes, and I wondered what you meant by the "etc."?

A That is always a wonderful thing. You can add anything that comes into your mind later on. Part of that is definitely uneconomic eggs, like in a chicken farm where your chickens go too far away that you do not go after the eggs because they become uneconomic.

Q And do you include in that word "etcetera" lease fuel, line heater fuel and those other things?

A No, sir, that is not in it.

Q And this 93.8 billion cubic feet of gas is gas which, after some deduction for lease fuel, drilling fuel and line heaters and so on, and wells not connected, whatever is left over will reach the plant, is that true?

A Yes, that is a fair assumption.

Q In the case of the D-3 estimate, Mr. Pot, you have indicated oil recovery plus or minus 45%. You have also suggested to Mr. Smith that there is a gas cap in this reservoir?

A Yes.

Q The permeability is high?

A Yes, sir.

Q And that there is besides evidence in your opinion of a strong water drive. Adding all of that together, Mr. Pot, don't you think that 45% recovery is perhaps on the low or conservative side?

A It is. It definitely is on the low or conservative side. The gas cap usually has not the effect that everybody would say at first glance, as to the ultimate recovery. It does not increase it to such a tremendous extent, while our water drive is starting to show up pretty nicely now. We had all the time a suspicion that it was there but we never had the figures that we can work from now, to state it so definitely. This figure plus or minus 45% is conservative as far as we can look at it now. Some people might not agree with me there. They might say it is high but that is my opinion.

Q In your opinion, what is the maximum figure we might look forward to there for recovery?

A Well, taking the text books, since I have not any reservoir with a gas cap and a water drive that I can check from experience, I would say we could go with a water drive to maybe 80%, while, if there was not a water drive, we might go to that figure of 45. We have a very thick zone of oil. We might even go higher.

A It was the thin zone in Leduc that I was afraid to add too much to its recoverable figure.

Q Would you place the recovery figures somewhere between say 45 and 80 per cent?

A No, I would not go that far.

Q How far would you go?

A Not in the Leduc field where we only have 38 feet of maximum oil saturation. I might go as far as, say, 60%.

Q 45% to 60%?

A Right, all depending again on whether we can keep that gas out.

Q Suppose, Mr. Pot, the recovery factor was 60%, how would that change your estimate of remaining recoverable gas 818 billion?

A Well, that is not an easy question,to say that right away. It would up it, sure.

Q Roughly, how much?

A Well, since all these figures are definitely arrived at by other things than are shown here, by calculations which could not be included in here, I am not in a position to say that, Dr. Govier, that I could figure it for you.

Q I do not understand that remark. These figures are arrived at by calculations not shown here, is that what you said?

A Well, sure. I did not include every figure that I arrived at from a certain process in here, but I would need to look at the effect.

Q I see what you mean.

A From the change of one figure. As a matter of fact, we would get more oil produced but we also would have a bigger

void space created by the production of the oil, and those are the figures that I am referring to that I have not got in here.

Q Well, Mr. Pot, you list an item called "Unrecoverable Gas in Oil, Standard Conditions, 39 billion". I do not suppose you could get any more than that, could you?

A Where is that? "Unrecoverable Gas in Oil, Standard Conditions." That is at 100 p.s.i.g.

Q Oh, yes. Well, let us not worry about it too much. The fact is, the 818 billion figure would go up somewhat, would it?

A It would go up somewhat.

Q Maybe to 850 or 900?

A Maybe.

Q Something like that. You made reference to the fact that you could not rely too much on experience elsewhere, Mr. Pot. Does that mean you do not anywhere know of a reservoir similar in character to the Leduc D-3?

A No, sir, I must confess I do not, not where we have that huge gas cap on top, thin oil, a water drive.

Q How would you rate qualitatively the general water and gas cap drive possibilities? Would you consider them fair or good or excellent in this reservoir?

A They are fair.

Q Just fair. Both the water drive and the gas cap?

A Yes, sir. Again because of the thin oil section.

Q One other question on D-3 gas, Mr. Pot. What portion of the 818 million cubic feet should be considered as gas deferred until after the recovery of the bulk of the oil?

A My answer to that will be rather ambiguous because we are not producing that reservoir as if it were an oil reservoir with a top on it and the gas cap above that. We are definitely producing some gas cap gas that we can not refrain from, so we produce that gas from the gas cap, it helps to lift the oil, and we will not produce then that gas from solution gas. What I am thinking of now, we are borrowing. Instead of saying we produce all solution gas and then at a certain point, fine, now we have all that gas cap ready for you; no, it is not like that, we are just producing part of the gas cap gas already but we may not produce part of the solution gas to the high extent that you might expect in a depletion type reservoir. The pressure is kept too high because of our water drive keeping up the pressure.

Q You have a ratio of 1 to 2 in your figures ultimate recoverable gas from oil and ultimate recoverable gas from gas cap?

A That is right.

Q Mr. Pot, would you give us some estimate of what that ratio would be in your final figure of 818 billion? Would it be the same?

A Eventually, yes, it would accumulate to the same percentage.

Q Accumulate to the same ratio of 1 to 2 but at any one time the producing ratio may differ from 1 to 2?

A Yes, sir.

Q Would you estimate what it might do at any one time?

A That again is the judgment figure which I would not like to go into, Dr. Govier. I have looked at that and I have

thought of trying to calculate it but there are so many judgment figures in it that immediately anybody can knock you over and say, "Well, I think it is different," and I can not say, "Well, you are not right, I am right," because of a judgment figure there of gas break-through.

Q All right. Let us take another approach. You have 603 billion ultimate recoverable gas from the gas cap. Multiplying that by 85% we would get 515 billion. Would you agree with that figure as the accumulated recoverable gas from the gas cap?

A That is, that if you take the 15% together for gas in the gas cap just the same, yes.

Q I gather that is what you have done here, is it not?

A Well, in some judgment calculations I figured that we would not have 15% lost through gas from the gas cap, which you can not produce from one well at the edge but you can always produce from a well in the center, being a gas field.

Q All right, Mr. Pot, let us pretend we are going to get 515 billion cubic feet of gas out of the gas cap at the time of abandonment or by the time of abandonment?

A How much did you say?

Q 515 billion.

A Let us assume that, yes.

Q Well, we will assume that. My question is simply this, could you tell me roughly what percentage of that 515 billion cubic feet of gas should be considered as deferred until the oil has been mainly produced?

A Yes. I can tell you the total amount of gas produced in the D-3. At the end of 1970 we would have 296 billion

cubic feet of gas produced. Now, whether that is gas cap gas that is left or whether there is still gas from the oil zone that will be produced after that, I leave that in the middle.

Q Then we go around in a circle, we come back to the point where the only way you can indicate to us what must be considered as deferred gas is for us to take your schedule and subtract those figures at any one time from the original gas in place?

A Yes, sir.

Q The difference is to be deferred?

A That would be the most reasonable one and not split it up into solution gas and gas cap gas.

Q I see the point, Mr. Pot. I wonder, particularly since this has developed, if a tabulation showing Mr. Pot's figures could be filed, Mr. Hamlin, the figures from which he read? If we have, say, the year and the gas from the D-2 zone and the oil from the D-2 zone, and then if Mr. Pot would even calculate the gas-oil ratio it would save us some work.

A We have that.

Q And then the same figures for the D-3 zone with the final total. I imagine that is what you have got?

A That is what I have got on the paper here.

Q Then from that we could get your estimate of the degree of deferment required for D-3 gas cap gas by subtraction, is that correct?

A You could do that in that way. That would be the most reasonable way to do it.

MR. HAMLIN: We would be prepared to file it.

CROSS-EXAMINATION BY MR. NOLAN:

Q Just one thing that occurred to me, Dr. Pot, in the discussion with Dr. Govier.

A Excuse me, may I put you straight. It is not Doctor. That was a degree I got in the Dinning Commission and I have not been able to shake it off yet.

Q Well then, Mr. Pot, in discussing your estimate of deferred gas with Mr. Govier, you see, you have got me doing it too, I understood that you made the assumption that there would be no break-through from the gas cap into the oil zone?

A That is a rather strong statement. I did not say "no break-through", I said we would like to keep the break-through as low as possible.

Q Yes, because the more break-through there is the more gas is going to be produced?

A Yes, sir. And I can foresee if we would have too high a break-through of gas that we might have to put part of that gas back into the gas cap to keep the water from flooding out our oil zone.

Q Thank you, Mr. Pot.

EXAMINATION BY DR. GOVIER:

Q Mr. Pot, I had one or two other questions in connection with the remaining sheets on your submission. In the case of Redwater I note you have not given the same type

of break-down, that is, you have not indicated to us recovery factors, porosity, connate water, thickness and area.

A That is right, Dr. Govier.

Q Is that information available?

A It is available because it has been given to the Conservation Board for Allowable Hearings.

Q That was a long time ago, Mr. Pot. Maybe Imperial Oil Limited have more recent information?

A We have not changed very much but there is no dark secret about that. Would you like me to state these figures to you?

Q If you would, please.

A Estimated acreage, 37,000 acres; average effective oil saturated thickness, 94 feet at a porosity of 6.2% and an estimated connate water figure of 15%.

Q The recovery factor?

A We are still using 40, but here again I dare say that that is conservative.

Q What limits would you place that recovery within?

A 40 to 60, and I hope that as soon as we have some information on flooding tests that if they work out that I am still conservative.

Q 40 to 60 and possibly greater?

A It would be greater, depending on the way it turns out.

Q Why is it, Mr. Pot, you always take the bottom figure of the range you use? Is there some basic philosophy involved here?

A Because it is far easier to raise your reserves than

bring them down.

Q Have you any views, Mr. Pot, on whether it might or might not be economical to gather gas from Redwater, or would you prefer not to give an opinion on that?

A I would prefer not to give an opinion because I have not studied it.

Q Do you have the same basic data for Golden Spike, that is, the comparable basic data?

A No, sir. Golden Spike is determined on pressure versus withdrawal.

Q I see, it is a pressure decline?

A It is a pressure decline.

Q Assuming no water expansion, is that correct?

A That is right, sir, assuming no water expansion. If water expansion is present we may have lower figures because of not being a constant volume reservoir but it may be higher because we get a water flooding.

Q Do you recall the figure you used for oil compressibility?

A 9.4 times 10 to the minus 6.

Q In the case of Excelsior, do you have the basic figures available?

A Yes, sir. 1750 acres, 63 feet of 6% porosity at 15% connate water.

Q And what does your little blue bible tell you about recovery?

A That says that we are using in that reservoir 30%.

Q 30%?

A 30%. As I said, there was an indication of a water drive but our initial pressures are not good enough to build too

much on that.

Q So you have just raised the solution gas figure a little bit?

A I raised it a little bit.

Q Because of a possible water drive. I think the sheet on the Provost field includes all the figures I might otherwise ask for, doesn't it, Mr. Pot?

A That is right.

Q MR. GOODALL: Can you tell us, Mr. Pot, where that connate water figure came from?

MR. C.E. SMITH: That is the 69 you are referring to?

A Oh yes, that has been discussed for quite a good length of time for the Dinning Commission. Some people say we believe it, others say we do not believe it. That figure is rather high, I must agree. It has been arrived at as far as I remember - - it was before the time I got here - - by a method that had to be adopted because of the shale in these sands, and it is not a straightforward restored state method. It is what they call - - it is an irreducible gas space connate water. It is a very big term but I know that they had figures in determining it. If it is that high, or if it is not that high, if it is lower, the reserves will come out higher. Besides, it all depends on the free gas equilibrium and the relative permeability curves whether it will produce water there or not at that high gas.

Q Then it is about three times as high as any other estimates we have had?

A It is.

Q On similar types of field?

A It may include the shale, that is what I am afraid of, but I had to use that figure, it was the only figure that was given. Instead of basing it on the 30% or the 35% we had a figure that we thought was better to use there than any judgment figure.

Q DR. GOVIER: Mr. Pot, when you were quoting the August production figures for the D-2 and D-3 zones I may have misheard you. Would you mind repeating those figures?

A I came out to an average daily production for the D-2 of 8,700 barrels and the D-3 7½. It was 680,683 for the whole month.

Q For the D-3?

A That is the Leduc-Woodbend together.

Q Is what you were talking about, the Leduc-Woodbend?

A Oh, yes.

Q When you divide 680 by 31 you get a bigger figure than 1250?

A I must have done that too quickly. As you can see, it is only a little slip of paper. Sure, you are right.

Q About 22,000, is it?

A Yes, that is right, it is about 22,000.

Q So the total production from Leduc D-2 and D-3 zones, not including Lower Cretaceous, in August would have been a daily average of 8,700 plus 22,000 equals 30,700 approximately?

A That is right, sir.

Robert Pot,
Exam. by Dr. Govier.

Q Mr. Pot, I know you are familiar with Exhibit J-21, which is the reservoir performance chart for Leduc D-3. In looking over the gas-oil ratio curve, Mr. Pot, I tentatively drew a smooth line through all of the data starting in June 1947 and going to the present time, and I am not sure that my smooth line is a good one or not. I tried to equalize the valleys and peaks of the curves and when I did that I came out with a starting point of 480 cubic feet per barrel in June 1947 and a terminal point at the present time of 560 cubic feet per barrel. I wanted to ask you first whether you would agree approximately with those figures?

A Yes, I agree with those.

Q And then I wanted to ask you whether you had any knowledge of, first, the average separator pressure prevalent in the field in June 1947, and, secondly, the accuracy of metering at that time as compared with those same two things at the present time?

A In 1947 the separator pressure there was in the neighbourhood of 100 pounds, 100 to 150 pounds. The metering was done in the field by production crews and the charts were read by the engineers in Calgary, So as far as the measurements go there, unless all the meters were out, I would say they are reasonable. To the end of the period I am definitely in favour of believing that the gas-oil ratios are measured to a satisfactory degree of accuracy. In between, sir, we have had some difficulties because of the little experience of people in the field who had to work with these meters, the people in the office that had to

calculate them, but as an average figure I would still say we were not too far off. It was the individual wells that gave us difficulties and we went into that and had a definite check on all these readings and improved them to a tremendous extent. Now, I am talking for Imperial Oil and I do not know how far the measurements of any other company are satisfactory or not.

Q What would you say about the average separator pressure in the D-3 zone to date? I realize there is dual separation in cases. If you can give us the effective separator pressure that would be fine.

A Dual separation was intended for 100 pounds first stage, 10 pounds second stage. I am not entirely familiar with the field operations but I believe that not all of those intended installations have been completed, and in many cases separators are producing at 50, 70 pounds, just whatever is the best one in that battery.

Q Would it be fair to say, though, that the average separator pressure declined to perhaps a quarter of what it was in June of 1947?

A I would not go as far as to say a quarter, sir. I might say between a half and three-quarters.

Q What effect would that have on the gas-oil ratio figures?

A You would have an increased gas-oil ratio.

Q Do you think that increase would be enough to account for any significant portion of the increase from 480 in June 1947 to 560 today?

A If all the operators decide to do it at one time, yes, sir, but I do not believe that it actually has been done that

way in the field. Maybe some of the operators tried to get away from the high gas-oil ratio penalty and produced their wells at 200 pounds.

Q I take it then, Mr. Pot, I just do not think we can come to any conclusion with respect to the effect of separator pressure practice on gas-oil ratio trend?

A Not yet.

Q Not yet?

A No, sir.

Q Fine. Thank you. Mr. Pot, you will be glad to know I have exhausted myself.

A I have not yelled.

MR. HAMLIN: Are you through with Mr. Pot?

CROSS-EXAMINATION BY MR. D.P. McDONALD:

Q Some questions I was going to ask, Mr. Pot, with regard to the Excelsior field again. Your estimate of reserves here is based entirely on D-2 Devonian?

A Devonian, yes, sir.

Q You have not an estimate of the Basal Cretaceous?

A No, I have not attempted them yet.

MR. STEER:

I wonder before you rise if I could clear my position. I have information to the effect that Northwestern Utilities in its Edmonton system can absorb all the gas that is available from the Leduc field. That information is based on figures which have been supplied by Imperial Oil, and I would like to ask my friend, Mr. Hamlin, if he

will undertake to produce Mr. Colpitts or someone from Imperial Oil who can verify the figures that are given to me so that the information I am instructed to give can be put before the Board, if the Board is interested in that aspect of the question.

MR. HAMLIN: Mr. Mackenzie will be back from New York, I think, on Sunday and I would be prepared to recall him and have him put in the estimates which I said we would like to put to the Board, and that would give you an opportunity to examine him on those estimates and those figures which have been furnished to your client.

MR. STEER: Those figures will be admitted by Mr. Mackenzie, will they?

MR. HAMLIN: Yes.

MR. C.E. SMITH: Why can not we put them in now, if that is the situation, and let us all have a peak at them?

MR. HAMLIN: The only objection I have is that you are trying to put them in through Mr. Pot, who is not qualified to say whether they are true or not.

MR. C.E. SMITH: Let us put them in by whoever received them. Surely there is no objection to that.

THE CHAIRMAN: I think part of the preliminary information would be given by Mr. Pot when he shows the gross production year by year and the question of Mr. Mackenzie or someone carrying on from those figures. Is that right, Mr. Hamlin?

MR. HAMLIN: Yes. I would prefer before any questions are asked in respect to these figures that

Discussion.

Mr. Steer has that we file this estimate that we have because it is my understanding, I am informed that these figures that were given to Mr. Steer were taken from this estimate.

(Go to page 616)

THE CHAIRMAN: You will file the information that Mr. Pot gave us, that is, with regard to gross production?

MR. HAMLIN: That is right. We will file also the estimate, and if you so desire we will recall Mr. Mackenzie next week.

THE CHAIRMAN: Yes.

MR. C. E. SMITH: Have we abandoned Friday?

MR. NOLAN: I have not, I have not.

THE CHAIRMAN: We will recess now.

(Hearing resumed after short adjournment)

THE CHAIRMAN: All right, Mr. Martland?

MR. MARTLAND: I will call Mr. Hawthorn.

.....

DAVID G. HAWTHORN, having been first duly sworn, testified as follows:-

MR. MARTLAND: Mr.Chairman, Mr. Hawthorn, who presented evidence on behalf of Western Pipe Lines at the end of September, has prepared some additional submissions pursuant to the request made by the Board, which were distributed on Thursday of last week. Perhaps it might be first convenient, it might be convenient first to allot exhibit numbers to those four documents, and I understand from Mr. Hawthorn that the proposed sequence is to commence with "A Proposed Gas Supply For Western Pipe Lines", and that would be the first of this group of four.

THE CHAIRMAN: Exhibit Number J-22.

BRIEF ENTITLED "A PROPOSED GAS SUPPLY FOR WESTERN PIPE LINES MARKED EXHIBIT J-22.

MR. MARTLAND: That is to be followed by "An Analysis of the Deliverability Characteristics of the Proposed Gas Supply for Western Pipe Lines".

THE CHAIRMAN: Exhibit J-23.

BRIEF ENTITLED "AN ANALYSIS OF THE DELIVERABILITY CHARACTERISTICS OF THE PROPOSED GAS SUPPLY FOR WESTERN PIPE LINES" MARKED EXHIBIT J-23.

MR. MATTLAND: That in turn, will be followed by the one entitled "The Deliverability Characteristics of the Gas Supplies presently serving Canadian Western Natural Gas Company Limited and Northwestern Utilities, Limited, that will be marked Exhibit J-24.

BRIEF ENTITLED "THE DELIVERABILITY CHARACTERISTICS of the GAS SUPPLIES PRESENTLY SERVING CANADIAN WESTERN NATURAL GAS CO., LIMITED AND NORTHWESTERN UTILITIES LIMITED MARKED EXHIBIT J-24.

MR. MARTLAND: And the other document is entitled " Some of the Important Discoveries and Developments of 1950".

BRIEF ENTITLED " SOME OF THE IMPORTANT DISCOVERIES AND DEVELOPMENTS OF 1950 MARKED EXHIBIT J-25.

MR. MARTLAND: As you will observe, sir, there are some references in certain of these exhibits to certain of the other exhibits, which, unfortunately, we were not able to number because we did not know what the exhibit number would be at the time. If you will take the first of that group, which will be Exhibit J-22, I will ask Mr. Hawthorn with regard to that.

Q As I explained, Mr. Hawthorn, the practice has now been merely to highlight any points in the printed submission which you would care to bring especially to the attention of the Board?

A Since this is the first exhibit, there is no reference in there to any other exhibit, and I believe the remarks that I made in there sufficiently explain the work that has been done on the estimation of the gas reserves which were presented or which we present as a proposed gas supply for Western Pipe Lines.

Q There is nothing special then that you want to stress with reference to J-22?

A I believe not.

Q Carrying on to J-23, then?

MR. STEER: What did you call it?

MR. MARTLAND: J-23.

MR. STEER: Yes.

Q MR. MARTLAND: That is the analysis of the deliverability characteristics of the proposed gas supply for Western Pipe Lines?

A On the first page of this exhibit, in the second paragraph, there is a reference to an exhibit number, and that exhibit number is J-22.

Q And there is a correction on Page 2, is there not?

A On Page 2 in the second paragraph, that word should be "Webster" and not "Western", it is the Stone & Webster Service Corporation. And referring to that exhibit, that exhibit is number 8 of Western Pipe Lines hearing.

Q Yes?

A I believe there are no other comments on the discussion there. I would like to call attention to the tabulations in the back part of this exhibit, and I want to refer to Table 1, Table 3B and Table 4B.

Q Yes?

A It will be noticed in Table 1, the first column listed - the second column listed daily maximum figures. The figures start with 140, 188, and then continuously on down through the rest of the 20 years as 256. Those are the figures which are Stone & Webster's Exhibit 8 of the Western Pipe Lines hearing. In order to detail the deliverability studies of the Western Pipe Lines requirements, I corresponded with Stone & Webster for some more detailed information as to the variation in peak demands throughout the year. They provided me with this information, and, at the same time, provided me with a later and more up-to-date figure for daily maximum, which has not changed very much but, at least, we should note it.

Q Yes?

A And that is that the 256 changes to 250 in both Tables 3B and Tables 4B, and I have used that figure in the deliverability studies, but I have used the figure 256 in Table 1 to be compatible with Stone & Webster's Exhibit 8.

Q Anything else?

A Maybe just a word of explanation will help make for a better understanding of Tables 2 and the set under 3 and the set under 4. Table No. 2 comprises the figure that has been taken out of the deliverability, the detailed deliverability studies presented in our original present-

ation to the Board, which was given the number of Exhibit 6. The detailed deliverability study of Pincher Creek, Pendant d'Oreille and Manyberries has just been put into a column and added up to make a total and compare with the total as shown in Table, in the last column of Table 1.

Now, the first footnote explains the discrepancy, if one picks the discrepancy between the total and the annual volume on page 1, and that is explained in footnote 1, which says,"Without attempting a balance and without consideratiom for peak loads." You will see that the figures in the total are more than the annual volume. I am referring to Table 2 now. In the second to the last column they are more for the first three years and less for the subsequent years down to 16. Now, all that has been done there is to make an accumulation, and when a cumulative deficiency occurs it has been set in the last column. If there is any misunderstanding of those figures, that will, I hope, serve to explain it.

Q Yes?

A Table 3, 3A, 3B and 3C, those Tables are a series of tabulations which present the principal detailed figures of our study, and the basis of this study has been to take Pincher Creek, Pendant d'Oreille, and the other miscellaneous fields and allow them to fluctuate up and down throughout the year, each one absorbing their respective shares of the peak loads. And it will be seen from Table 3 that the deficiency starts in about the 11th year and then accumulates on to some 83 billion or 7-4/10% of the total requirements. I think Tables 3A, 3B and 3C are

pribably self-explanatory. They just give more of a detailed data.

Table 4, 4A, 4B and 4C, those Tables are on a different basis, as explained in Footnote 1. That footnote is, "Full consideration for peak loads and well allowables. Pincher Creek held at constant rate. Pendant d'Oreille used for storage. Peak loads absorbed by Pendant d'Oreille and others." And that has been the basis for this deliverability analysis. And the final one is that deficiencies start in the 15th year, and accumulate on to some 37 billion cubic feet of undelivered gas or 3-3/10% of the total estimated requirements.

Q That is all the explanation you want to make on that?

A Yes, I think so. I think, probably, if there are other questions, it will be brought out in cross-examination.

Q Yes, I think it will be brought out.

A Yes.

Q On cross-examination.

A Yes.

Q Then going on to J-24, Mr.Haw thorn. On page 4 there are some references to exhibits?

A Yes. The second paragraph on Page 4 reads,"Additional supplies for Canadian Western's system could be obtained from the gas reserves in the southern part of the Province which have been analyzed in exhibits J-22 and J-23."

Q Yes. Do you want to make any special comment with regard to the Tables or graphs there?

A The analysis of the Northwestern Utilities Limited system and the Canadian Western Natural Gas system has been, the deliverability analysis has been run on the basis of

reserve estimates on these fields presented by Ralph E. Davis. The reason for this is principally that we have felt that Mr. Ralph Davis has been very close to these fields, has followed them for years, and he is a very reliable estimator, and his reserves are as conservative or more conservative than most other estimators. And it was our idea to try and show the Board in this analysis what could be, the least that could be expected out of these gas supplies for the two systems.

Q Yes?

A There are two curves presented which may bear a little explanation. One curve is presented for the Canadian Western Natural Gas Company Limited. This is a graph where annual gas volume in billions of cubic feet are applied against 31 years inclusive, 1950 through 1980 inclusive. Again this is, as I explained in our original hearing, this is a time-rate curve, and, therefore, any area in one of these curves is representative of gas volume.

Q Yes?

A Where the curves are presented in Exhibit 6 were daily rates applied against time, these are annual rates applied against time. I just want to make sure of that. That is right. The various lines represent the annual deliveries from the various fields in that respective year. The top line shows the estimated requirements, and is a graph of the requirements of Canadian Western as presented by Ralph E. Davis and estimated by Canadian Western.

Q The same thing applies with regard to Northwestern?

A Yes.

Q I do not think you have any special comment to make with regard to J-25?

A The only comment I have to make in connection with J-55....

Q J-25?

A J-25, is in regard to the several statements that were made in Exhibit 6 concerning our optimism for future discoveries and future reserves yet to be discovered and developed in the Province.

Q Yes?

A We have taken the liberty of itemizing a few of what seemed to us to be the important discoveries of the last nine months, or during 1950.

Q Mr. Hawthorn, have you any general comments to make, or conclusions to state, with regard to all four of these exhibits? If so, would you make them to the Board now?

A Mr. J. O. Lewis is, as you know, my partner, we act as Petroleum Consultants, and who testified with me om Exhibit 6, is not here. We felt that I might probably present to the Board his thinking on the thing, and in between the completion of these exhibits and now I had returned home and discussed these with Mr. Lewis.

Q Yes?

A And he wanted to jot down a few of his thoughts, and his thinking on it, and I would, if you please, like to read these to you. They are my thoughts too, but they are Mr. Lewis's conclusions, and his alone, in the matter.

1. We wish to emphasize that the curves showing the

deliverability for Canadian Western Natural Gas Company amd Northwestern Utilities appear to assume the worst possible conditions that can reasonably be envisioned, and that there are several recourses that will be available.

2. The estimates are based entirely on proven reserves now contracted to these markets and that it may be anticipated that some extensions and additions will occur.

3. They also assume that no help will be received from new discoveries that will be made in these areas.

4. They also assume that full demands of all consumers be met on peak days but some half of the peak demand is interruptible industrial load which in the United States would be required to hold standby fuel oil or powdered coal equipment. Should the companies fail to find any additional reserves over presently estimated supplies, it would not be until 1967 that domestic or other imperative peak demands could not be met for Canadian Western, and not until about 1975 that the imperative peak demands could not be met for Northwestern Utilities.

5. The deliverabilities could also be extended several years by drilling more wells than estimated. From the financial point of view this would not be desirable and would not be done except for such emergencies.

6. We wish to reiterate our belief that some space in the demands be left cor oilwell gas. The new discoveries between Stettler and Edmonton point to discoveries of large gas production near the Edmonton-Calgary markets which will be pressing for outlets.

7. We believe that the reserve-deliverability picture is on the whole a healthy one; that it would be both unnecessary and unwise not to leave room for new supplies, especially oil well gas, and that ample time is foreseeable for obtaining the additional needs, especially in view of the active prospecting going on and the large untested potentialities of the Province, particularly in the Edmonton-Calgary area. Furthermore, imperative deliveries can be extended for a number of years if necessary by the recourses that have been suggested.

Q Is there anything else that you wanted to add, Mr. Hawthorn, to that, or is that the submission?

A We have also drawn up a list of conclusions here which deal with reserves in general, and other angles to the problems that are not directly, or should we say, indirectly associated with reserves that I would like to read, if it is not out of order.

Q Yes?

A I think we shall list those as our final conclusions on the problem.

1. We do not believe that there is an exportable surplus of proved gas reserves in the Province

at this time.

2. The surplus, over and above gas committed to the Province, is practically all a combination of proved and probable reserves.

3. More development drilling is needed to firmly prove the existence of these reserves and make them capable of serving a large transmission line.

4. If the proper assurance with a market outlet, sales and income were given, it should not take more than a year, or possibly two at the outside, to adequately prove these reserves.

5. Meantime, much more gas would have been discovered and the tension and question over an adequate supply for the Province would have been alleviated, if not eliminated.

6. The gas reserves committed to the Province are practically all proved and constitute a strong and substantial group of reserves.

7. While detailed deliverability studies show that all estimated demands may not be able to be met from the presently committed reserves only, for more than a period of from ten to fifteen years, this is not considered to be dangerous, nor an unhealthy condition.

8. There are so many good sound recourses that are amply capable and may confidently be expected

to make up deficiencies for the 30-year requirements fully, that it would seem unwise to go further at this time, or until good opportunities presented themselves or until unforeseen difficulties or dangers occurred, to go further in providing additional supplies for the Province.

9. In conclusion, it would seem that the one thing most needed at this time is to prove up the probable and potential reserves, so that all interested parties may be assured of the quantities of gas that exist or may reasonably be expected to be discovered in the future, and not have to rely on estimates made on one well's discoveries. Such estimates are at the best rough approximations, which are subject to wide variations due to lack of sufficient data, and wide differences in opinion and interpretation.

10. To accomplish this, some incentive or assurance of a market outlet is needed to induce operators to continue to invest money in currently non-paying enterprises, if not actual liabilities.

11. As we have stated before, and in the light of all existing circumstances,it is felt and suggested that the Petroleum Board might well consider the issuance of a conditional export licence, or any other similar type of document or order which the Board might choose to write, which,in substance, would grant a period of time for the necessary things to be accomplished before firmly granting the licence.

Q Thanks, Mr. Hawthorn. Would you answer any questions that may be put to you.

.....

CROSS-EXAMINATION BY MR. S. B. SMITH:

Q Mr. Hawthorn, I was interested in hearing your explanations of your briefs. I would like to take you to J-23 for the moment, and that is the analysis of the deliverability characteristics.

A Yes?

Q Now, in J-23, you show in Southern Alberta roughly a marketable gas of 1688.5 trillion cubic feet, is that right?

MR. C. E. SMITH: Trillion?

Q MR. S. B. SMITH: That is Page 1. Billion, I am sorry.

A Right.

Q And that is not very nearly enough to provide for your proposed export system that is Western Pipe Lines, isn't it, is that right?

A That is right, yes, sir.

Q Because that leaves you with certain deficiencies that are shown on Tables 2 and 3, but comparatively minor deficiencies?

A Right.

Q And you now say you do not believe there is a proved exportable surplus? Your system would require something in excess of 1688.5 billion cubic feet then, obviously?

A Mr.Smith, in my original Exhibit 6 I qualified these reserves, and I definitely stated in that exhibit, and I probably should have reiterated it here, that the

estimate of Pincher Creek is definitely on the proved and probable side or class.

Q Yes, all right.

A I do not consider that this group of gas reserves under this proposed supply is anything more than a group of proved and probable supplies which will need to be firmed up by additional drilling.

(Go to Page 630)

Q Yes, all right. Now tell me when was your firm first consulted, Mr. Hawthorn, in this matter by Western Pipe Lines Limited?

A I do not understand your question.

Q When was your firm first consulted in relation to these matters by Western Pipe Line Limited, or someone on its behalf?

A I believe it was some time in April or May.

Q Are you sure it was not as early as February 1950, or do you remember?

A It may have been that early, Mr. Smith. I don't recall. What I was going by mostly was about the time we started working on it and I presume we were contacted on it probably a month or maybe more before that. So that might bring it down to maybe March.

Q It could have been possibly in February 1950?

A It could have.

Q Well, can you tell me, did you at that time advise Western Pipe Lines Limited whether or not there was in your opinion natural gas in Alberta in excess of the present and future needs of this Province?

A You mean before we even started our study did we advise our clients?

Q I do not know just when you started your study but I would like to know whether, back in February 1950 or at or about that time, you advised Western Pipe Lines Limited whether there was or was not natural gas in this Province in excess of the present and future needs of the Province?

A At that time we were totally unfamiliar with the reserves

of the Province and we could not have made any such statement to our clients.

MR. C. E. SMITH: Aside from those newspaper editorials, maybe.

Q MR. S. B. SMITH: I would like to read you a statement from the application of Western Pipe Lines Limited, made on the 10th of February 1950, signed on its behalf by L. D. M. Baxter, President and K. W. Campbell, Secretary. I am reading from page 2, paragraph 3:

> "Western Pipe Lines is of the opinion, based on studies made on its behalf, and reports presented at the hearings before the Natural Gas Commission, and developments occurring in the Province of Alberta since those hearings, that there is natural gas in the Province of Alberta in excess of the present and future needs of the Province, and that of this surplus part could be transported outside of the Province without adversely affecting the availability of natural gas to the consumers in Alberta."

Did you give that advice to Western Pipe Lines Limited on or about last February?

A No, sir.

Q Did you make the studies on behalf of Western Pipe Lines Limited that are there referred to by Colonel Baxter and by Mr. Campbell? The studies he refers to there as having been made on its behalf?

A No, sir.

Q You did not?

A No, sir.

Q Now Colonel Baxter, however, made some other statements on September 28th and at page 299 of the transcript he says:-

"I have had as long an experience in this business as anybody in Alberta in the industry and I am of the opinion that before any question of export is granted that we are going to have to find more gas than is presently available to support any export line."

The statements appear to be somewhat in conflict, don't they?

A I would say so.

MR. MARTLAND: Are you asking him that as a geologist?

MR. S. B. SMITH: He is here presenting the geological evidence on behalf of this company.

MR. MARTLAND: But he is not being asked as to conflicts between two statements in two different documents.

Q MR. S. B. SMITH: I will read you another statement of Mr. Baxter's. He said at page 301:

"But over and above all that, the market that can be served in Eastern Canada is of a magnitude that I am quite sure the gas is not available in this Province if you are going to reserve sufficient for the people of this Province at this time, which means that we are discussing a hypothetical case that in 5 or 10 years from now may be feasible, but I do not think it is feasible today."

You would not be in agreement with that statement, would you?

A I think I just stated a few moments ago that I thought probably a year or two it would take to firm up some of the reserves.

Q Yes. Now, Mr. Hawthorn, you have in numerous places in your brief referred to the evidence of Mr. Ralph E. Davis?

A Yes.

Q You regard Mr. Davis and Mr. Davis' opinions very highly, do you not?

A Mr. Davis has a fine reputation, yes, sir.

Q He is one of the highest ranking Petroleum Consultants and Geologists on the continent, is he not?

A Yes, particularly on gas reserves.

MR. C. E. SMITH: Did you ask Mr. Dodge about that, Mr. Smith?

MR. S. B. SMITH: I hardly needed to.

Q Mr. Davis discussed at considerable length the requirements of the cities of Edmonton and Calgary, Mr. Hawthorn, and at page 46 of the transcript he was talking about additional requirements of the City of Calgary and he said, under the heading of "Conclusions",

"(2) To meet estimated peak requirements in 1980, it will be necessary at that time to have a reserve of at least 500 MMMCF. If that conclusion be not clear, I will say that to meet the peak flow of gas required, it requires wells with sufficient pressure and with sufficient reserves

"to produce the needed quantity and I would think that 500 billion would be a minimum."

I think you would agree with that statement of Mr. Davis' wouldn't you?

A Yes, sir, I think I have in my - -

Q Yes, you have given us the same thing in effect, I think?

A Yes. That was in connection with Northwestern Utilities, was it?

Q No, that was in connection with the Calgary operation I was reading, dealing with Canadian Western. In your figure of 1688.5 billion cubic feet referred to on page 1 of J-23 if you take out 500 billion cubic feet as an additional reserve for the City of Calgary, it would leave you with 1188.5 billion cubic feet, would it not?

A Yes, sir.

Q And that withdrawal would not be sufficient to fulfil the requirements of Western Pipe Lines or anything like it, would it?

A Yes, sir.

Q So that obviously on your own figures based on gas reserves which you refer to on page 1 of Exhibit J-23, I think you will agree it would be quite impossible for Western Pipe Lines Limited to obtain an export permit at the present time. I think you will agree on that, won't you?

A Canadian Western is to get - -

Q To be provided with 500 billion feet.

A From these reserves?

Q Out of these reserves.

A From these reserves.

Q Actually, Mr. Davis suggested that at least there was a possibility of providing for Calgary out of these reserves, didn't he? Do you remember? Perhaps you have not read his evidence?

A Yes, I think he did.

Q I will read his evidence if you wish. I think you will agree that he did. Now, I would like to ask you, I think you would also agree that Pincher Creek is really not in itself a suitable reserve to be acquired by the Canadian Western Company and developed by the Canadian Western Company. I am not saying whether it is a suitable reserve or not. I am just suggesting to you that it is not a suitable reserve to be acquired by the Canadian Western Company and developed by the Canadian Western Company. I think you would agree on that, wouldn't you?

A I certainly would for one primary reason and that is suggesting that Canadian Western look to the North.

Q That was the view you put forward in one of the briefs you filed here today?

A Yes.

Q But if in accordance with Mr. Davis' views the Canadian Western should look to the South, say for this 500 billion, then if Pincher Creek were developed by some interest apart from the Canadian Western, the requirements of Canadian Western presumably could be taken care of possibly out of Pakowki Lake or Pincher Creek, if developed by some other interest and then it would not be necessary for

it to go to the north as suggested by you?

A That is right.

Q And I think you will also agree with me that the most suitable way to develop Pincher Creek is to have an export system because there is no market really for Pincher Creek gas in Alberta unless an export system is created?

A I will answer that by saying that Pincher Creek, being a high pressure field with large capacity wells, is suitable, most of all, to a transmission line.

Q Such as an export line?

A That is correct.

Q If Pincher Creek is developed, then obviously some gas could be made available to the City of Calgary possibly to fulfil the 500 billion that is referred to by Mr. Davis?

A That could be split, yes, sir.

Q And that might be the provision of a very considerable additional reserve to the City of Calgary as suggested by Mr. Davis, might it not?

A It could be, yes.

Q Thank you.

CROSS-EXAMINATION BY MR. FENERTY:

Q MR. FENERTY: I have a question or two I would like to ask Mr. Hawthorn. Mr. Smith pointed out Mr. Ralph Davis was of the view that Pincher Creek reserves should be used for Canadian Western. I do not know whether you have reviewed the various reports. I wonder if you remember Dr. Dodge in J-11 in working out the requirements for the Province has Pincher Creek as an area that will supply

the internal consumption and not for the export market and his estimate on that ground he gets the 30-year supply by using Pincher Creek for Provincial supply. Now you will remember that Dr. Dodge's principals do not need Pincher Creek. You remember he was giving evidence on an application from those smaller areas south?

A Yes.

Q So he puts it in with the local requirements. Now your principals do need Pincher Creek, I gather, so you disagree with Dr. Dodge and with Mr. Davis and you say that the Calgary supply should look to the north. I wonder if by any chance you have noticed, or taken the trouble to analyze, as I have, the evidence of the experts throughout and if you have not found that whether gas is needed or is not needed depends on the particular requirements of the principals. Practically every expert that has given evidence here, have you noticed that?

A Mr. Fenerty, I knew that this question would be asked sooner or later.

Q I imagine you did.

A If it reflects on a man's sincerity in the statement he makes I will answer your question by saying I had the utmost sincerity in making the statements that I did. It had no bearing on whether or not Western should use Pincher Creek. I still say Pincher Creek is not an ideal type of gas supply for domestic companies.

Q Do not misunderstand me. I am not questioning your sincerity and I am not questioning theirs, but we will put it this way. It is a coincidence that various interests

had happened to hit on experts who had those views. Will that meet the situation?

A If you wish.

Q And would you think, if that is so, that we should perhaps do what I believe - correct me if I am wrong - what I believe the Federal Power Commission does, to require some adjudication by, shall I say, some more or less independent witnesses? I think that is a Federal Power Commission requirement. I do not know but I think so. Do you think perhaps that would be a way to be reasonably sure we know where we are going without regard to any special interest. That is the suggestion I am throwing out.

A That is a good suggestion, and we could get a good unbiased opinion.

Q Speaking as a layman I am greatly concerned by the evidence as it comes out, it just shocks a layman very badly. You can realize that, cannot you?

A I tried to make statements in here with all possible sincerity. I actually stated that I did not believe Canadian Western could now use Pincher Creek if they wanted to. I do not see how it could unless at great expense they bought the reserves in the ground and if they did that, the consumers would have to pay for that and that would really cost money.

Q And would you agree with me the more sincere the witnesses are, the worse it is, because it indicates that they have no definite knowledge as to what should be done. I will leave it with you, that thought.

CROSS-EXAMINATION BY MR. NOLAN:

Q Arising out of what Mr. Fenerty has just been discussing, we have heard a good deal about Dr. Hume during these hearings?

A Yes.

Q Would you say he was an impartial and unbiased reserver and estimator?

A I would think so. At least, he certainly has a reputation and would attempt to be so, yes, sir.

Q At the bottom of page 1 of J-23, I was just going to ask you one question about that, Mr. Hawthorn, it is where you set out gas in place, recovered gas and marketable gas with respect to some half a dozen fields beginning with Pincher Creek?

A Yes.

Q And going on down to Smith Coulee. Are those proven fields, Mr. Hawthorn?

A Pincher Creek is a proved and probable gas reserve. I expressed that I thought Pendant d'Oreille was principally proved in Exhibit 6.

Q Yes?

A I suggest the same thing for Manyberries. I said that Princess-Patricia was definitely proved and probable. I think the others are proved and probable also.

Q Then what it means is that Pincher Creek is proved and probable and so is Patricia, Princess, Black Butte and Smith Coulee?

A Yes.

Q And the other two being proven, Pendant d'Oreille and Manyberries?

A I think those two reserves are quite well established.

Q Those that are in your judgment and your opinion proven and probable, are they sufficiently proven to justify the construction of a pipe line?

A No, sir, I do not think so.

Q You do not thirk they are?

A No, sir.

Q You think there has to be more drilling, do you?

A I think they have to be further established by more drilling.

Q Is that true of each of those fields I have been mentioning, Pincher Creek, Princess-Patricia, Black Butte and Smith Coulee?

A Well each of the fields has to stand on its own legs. This group is delivered to one pipe line, of course.

Q Yes?

A I do not believe this group is sufficiently proved at the present time to support a pipe line.

Q Yes, I follow you. All right.

CROSS-EXAMINATION BY MR. FENERTY:

Q May I ask you one more question? This has reference to Dr. Hume. I do wish you to understand that I am not proposing to follow the course of anybody else in contrasting the ability or sincerity of anybody. I am going to give full credit to everybody and certainly to Dr. Hume, yourself and the others. But as an illustration of where these differences arise, I will point out to you - did you read Dr. Hume's report to the effect that he takes

an abandonment pressure of 14.4 or 14.8 per square inch absolute, which I understand is equivalent to a zero reading on the gauge. And did you hear Mr. Mackenzie giving evidence on behalf of a company with long experience in this field that their experience was that a 100 pound abandonment pressure would be the lowest that in their experience they could go? Now I suggest to you that so far as Dr. Hume's figure on abandonment pressure is concerned it is what I would call an ivory tower figure. It has no relationship to the practical production. Would you agree with me?

A Mr. Fenerty, I think you must misunderstand Dr. Hume's estimate.

Q I think I am right.

A On his last estimate he tried to make an estimate of gas in place and he found 14.4 because of the objection that was raised in his first report of using 100 pounds. In his last report he tried to refrain from setting forth his reserves as recoverable reserves and tried to state them mostly as gas in place.

Q In estimating his recoverable reserves he did take it down to zero on the gauge, didn't he?

A No, he took it down to 100 pounds.

Q In the Leduc - in the Kinsella field, that is the one I am referring to. Well, I had better leave it if I am not accurate. But y recollection is that Dr. Brokaw followed his figures. My recollection is that Dr. Hume in the Kinsella field, he took it down to 14. something on the gauge. If I am wrong, I have not got the right analysis.

In any event, I am pleased to be able to state that I am not, in following this line of examination, I am not attempting to contrast either the abilities or the honesties of any witness as against any other, or discrediting you or anybody else with dishonest motives. Please accept that.

A Thank you.

Q BY MR. NOLAN: Do you have the particulars of the bottom hole pressure Dr. Brokaw used?

A No, sir, I have not had time to go over it.

Q I am told it is 270 pounds in Kinsella?

A Yes.

Q Do you remember that, or do you not know?

A No, I do not.

CROSS-EXAMINATION BY MR. McDONALD:

Q Mr. Hawthorn, in regard to this matter of continued drilling, is it true that there is another well being drilled in Pincher Creek at the present time?

A That is my understanding, yes, sir.

Q So that there will be within a reasonable time an additional well completed in that field?

A Yes, sir.

Q And that will improve the possibilities of establishing the proven and probable of that reserve?

A That is right. That will help.

Q I was interested in your conclusions where you referred to the incentives of the issue of a conditional permit or some type of Order of the Board which would give some-

body some reason to continue drilling.

Would this Turin field be an example of what you have in mind? I notice in your report that you state the field has no way of telling the areal extent of the reserve, nor of satisfactorily estimating the amount of accumulated gas.

A I think Turin was probably one of the numerous ones that would quickly be better developed if there were assurances of a market for the gas.

Q And on a straight businesslike approach to the problem, would you expect that the owners of that particular field will spend no moneys on it unless there is an incentive for the sale of that gas?

A Whether they will or not depends on their budgets and quite a number of things that are particular to their own problems.

Q If they have the money and they want to invest it over many years, they would continue to drill in that area without the assurance of a market?

A They might choose to spend it on wild cat wells rather than development drilling.

Q In other words, they would continue their search for oil in other parts of the Province, rather than drill for gas in that particular area?

A Generally that would be my conclusion, yes.

Q It just occurred to me that is a particularly well located gas reserve, insofar as Alberta is concerned, if it were proved up. It stands right almost in the middle of the settled part of the Province, does it not? The Turin area?

A Yes.

Q It is just due north of Lethbridge, is it not?

A Yes.

Q That is what you referred to when you said there might be any number of fields discovered that could be useful for either local requirements or export lines?

A That is right.

Q Favorably located?

A That is right.

Q Now in dealing with that particular field, Mr. Hawthorn, that is in J-25, and it is on page 2, you referred to wells tested at 8000 MCF per day, with a very little bit of oil and some salt water. Was that a drill stem test? I mean is that figure evolved from a drill stem test?

A I think that is a perforation test, Mr. McDonald.

Q Then on the similar fields throughout you have referred to tests. If you go to page 5, the Big Valley-Devonian discovery and in the last sentence:

> "In addition about 1000 Mcf. of gas per day was tested in the Viking and Lower Cretaceous formation."

That also applies to a drill stem test?

A I think so, Mr. McDonald, yes. As far as could be ascertained from the scouting reports and other information I developed the statement from.

Q Yes. Then you referred to - - would the same apply to the Signal well discovery which you report as having been tested?

A Yes.

Q In the Northern part of the Province and in the Peace River

area?

A Yes, sir. The reports are not always clear as to whether they are drill stem tests or completion tests.

Q Now referring to J-23, Mr. Hawthorn, you illustrate in your Tables, your Tables show deficiencies both in total gas requirements and deliverability?

A Yes, sir.

Q And on page 4 there is some comment on that. Towards the middle of the first paragraph you state:

> "The deficiency is only 7.4% of the total 20-year requirement, and is absorbed by curtailment of interruptible loads during period of peak demand."

Now what you have in mind is that insofar as an exporting company is concerned, that would be one method of meeting the problem of deliverability?

A That is right. That much gas just would not be delivered to the interruptible load customers.

Q Was that why you carried on and said:

> "This much deficiency would not be considered serious."

A That is correct.

Q There is another method of handling it and that would be by peak shaving arrangements with any of your customers that had that facility.

A Well, that is about what it amounts to, Mr. McDonald, is during the winter months of peak load you just cut some of the interruptible load down a little bit, or maybe off entirely.

A There are gas companies in that area, I understand, that cut some of the interruptible load off for weeks at a time during the cold weather season.

CROSS-EXAMINATION BY MR. S.B. SMITH:

Q Could I ask another question, too, sir? Mr. Hawthorn, in your opinion, are the gas reserves in Alberta at the present time, proved and probable, sufficient to meet the long range requirements of Alberta and at the same time able to meet the demands of a large transmission line designed to export sizable quantities of gas out of the Province to other markets?

A You are reading from my page - -

Q I am asking you a question.

A I would like to have the whole statement read there or a reference to it so that I understand.

Q Do you object to answering my question?

A Will you read it again, please, then?

Q Would you repeat my question?

BY THE REPORTER READING: "Q. Mr. Hawthorn, in your opinion, are the gas reserves in Alberta at the present time, proved and probable, sufficient to meet the long range requirements of Alberta and at the same time able to meet the demands of a large transmission line designed to export sizable quantities of gas out of the Province to other markets?"

A THE WITNESS: I think my answer is "yes" to that, Mr. Smith; if I understand it correctly, yes.

Q You think the reserves are sufficient?

A That is correct.

Q To look after the long range requirements of Alberta and at the same time be able to meet the demands of a large transmission line designed to export sizable quantities of gas. You do not think there is any conflict in your answer there with the answer you made earlier this morning that there is not an exportable surplus at the present time?

A Oh, proved gas reserves, Mr. Smith, please, and I think this is qualified by "proved and probable".

Q Well, in order to have proven reserves you have really got to have the gas, haven't you?

A That is right.

Q And you have got to have the gas to export, haven't you, Mr. Hawthorn?

A That is right.

CROSS-EXAMINATION BY MR. D.P. McDONALD:

Q Just one question, Mr. Hawthorn. In providing for a gas supply for a pipe line, Mr. Hawthorn, wells are not actually drilled prior to the scheme being placed in effect? What I have in mind, two or three wells may be all that will be in a field at the time a permit is applied for with the potential of developing it as the gas is required?

A That is right. If those two or three wells give sufficient evidence to make a fairly reliable determination of a reserve.

Q That is true. Now, looking at the further situation, isn't it a fact as far as Alberta gas is concerned to the

Canadian Western and Northwestern Utilities, that outside of possibly the Jumping Pound and Kinsella fields, all of the wells are actually drilled and producing, the gas reserves are absolutely proved up?

A The gas supplies for the two gas companies, you mean?

Q Yes?

A Yes. The only probable reserve, I would say, that is not proved and probable is Jumping Pound. Jumping Pound still has - - the full reserve has to be demonstrated by additional drilling.

Q Yes.

CROSS-EXAMINATION BY MR. STEER:

Q And what would you say if experience has shown, Mr. Hawthorn, that some 25 odd square miles had to be taken out of what has up-to-date been regarded as the proven reserves in Viking-Kinsella? We have some evidence here that wells in the northeast corner of that, what has been regarded up-to-date as a proven reserve, are water wells and that probably a large area in that northeast corner will have to be abandoned.

A Mr. Steer, my deliverability study indicates that in the 30-years we can deliver 578 billion cubic feet of gas out of Kinsella, which is less than any of the reserve estimates, I believe.

Q I see.

A And the deliverability problem, we have not still extracted all of the gas that is there.

Q That is so. Then you suggested to my friend, Mr. Smith,

that probably a division could be made between the Pincher Creek gas, between a possible export line and the Canadian Western system?

A I just answered him by saying that that could be, and that is possible, that that arrangement could be made, I presume.

Q Had you in mind at that time that on Mr. Davis's estimates 10 or 12 years will elapse before Canadian Western requires this additional supply?

A Well, yes, and I know of that and I think the statements I made recognize that, that Canadian Western can not use - -

Q Quite so, you made that statement.

A I made that statement.

Q Now, let us look at the future 10 or 12 years hence, and assume that Pincher Creek has been produced during that time for an export line.

MR. S.B. SMITH: To what extent?

Q MR. STEER: What would you say as to the possibility of Pincher Creek at that time being able with its reduced pressure to supply peaks to Canadian Western? Would there be any problem there?

MR. S.B. SMITH: Surely that would depend on how much gas you were going to take out of Pincher Creek.

Q MR. STEER: Perhaps the witness would answer the question.

MR. S.B. SMITH: How can he answer it?

MR. STEER: If he can not answer it perhaps he could say so.

A THE WITNESS: Well, I think that is entirely likely, that it can be done. I do not think exporting out

of Pincher Creek will deplete that reserve in that length of time to the point where Pincher Creek could not be used to assist in peak demands for Canadian Western.

Q I see.

CROSS-EXAMINATION BY MR. FENERTY:

Q I do not know whether the Board has it here but could I have that exhibit, Dr. Hume's report, if it is here? I am sorry about this. Have you got it?

A I do not think so.

MR. C.E. SMITH: I have a copy in the bottom of my locker.

MR. FENERTY: I was afraid if I went out the witness might disappear.

THE CHAIRMAN: I think Dr. Hume's report gave gas in place only of 14.4 pounds.

MR. FENERTY: I think he says "gas available to 14.4 pounds".

THE CHAIRMAN: Yes.

Q MR. FENERTY: Then if we are agreed or that, what does that mean, Mr. Hawthorn, gas available to 14.4 pounds? You can give me a sensible meaning to it now. Has it anything to do with producing it?

A Well again, Mr. Fenerty, I think Dr. Hume's report clearly states that his estimates down to 14.4 are gas in place.

Q You tell me what this means, "gas available to 14.4 pounds."

A Well, that is gas in the ground that is available for production.

Q It is in the ground but available for what?

A For production.

Q Brought down to 14.4. It is not 14.4 in the ground, is it?

A That does not mean we are going to recover it all.

Q Just a minute. It is not 14.4 in the ground, is it?

A No, sir.

Q Now, when you talk about things as in the ground, as available down to 14.4 - - you are an engineer and I am not - - is there any logical meaning you can give to that amount of gas if you bring it down to 14.4? Now, you tell me.

A That is the quantity of gas.

Q Just tell me, is it so or not?

A That is the quantity of gas Dr. Hume estimated in place in the reservoir subject to recovery.

Q Subject to recovery down to 14.4, isn't it?

A That is the amount of gas measured at a pressure base of 14.4.

Q Now look, you intimated I did not know what I was talking about.

A I am sorry if I did it.

Q I want you to give a correct meaning. An engineer should be able to give a clear answer to a layman on the meaning of gas down to 14.4 in the ground. That means that gas is available down to 14.4, correct or not? You just tell me if it is correct or not.

A I think that is a misinterpretation of it.

Q What does the 14.4 have to do with it?

A That means it is measured to a pressure base of 14.4.

Q In the reservoir?

A Yes, sir. All the gas in the reservoir is measured on a pressure base of 14.4.

Q Oh, just measured at that?

A Measured at that, that is right.

Q What does the word "available" mean, do you know?

A Yes, I think so. I mean, it is in the reservoir available for production.

Q At 14.4?

A Measured at a pressure base of 14.4, yes, sir.

Q And why 14.4?

A Because we have to have some pressure base to measure gas at.

Q Isn't it the gas at production pressure that is available? It is entirely a different figure from what is available at a production figure?

A You get a different figure every different pressure base you use. That is our standard pressure base, 14.4. That is what they mean by S.C.F., standard cubic feet of gas.

Q You measure your figure when you are going to find out how much gas we are going to deal with, you convert it into 14.4 in the reservoir pressure, do you?

A Yes, sir.

Q Which multiplies it perhaps 10 times, 100 times?

A More like that, depending on the pressure of the reservoir.

Q And that bears no relationship to what you are going to produce, is that right?

A That is the amount of gas that is subject to being produced.

Q That is the amount of gas that is subject to being produced?

A. Oh, yes, sure it is. It is the figure of the amount of gas

that you have subject to production.

Q I see. Well, I guess it is just because I am a layman.

A Maybe I could make you understand, Mr. Fenerty. The pore space in the reservoir is filled with gas at a high pressure, you see.

Q I know that.

A And in one reservoir it is one pressure and in another reservoir it is another. Now, it doesn't do any good to think of a cubic foot of pore space filled with gas, we have to reduce that gas down to a common denominator, and the common denominator is the pressure base.

Q 14.4?

A Yes. In other words, it is taking the squeezed volume of gas in the reservoir and expanding it.

Q It is an item of measurement only?

A It is an item of measurement only, that is right.

Q And if you are doing that it is not gas that is available at all, is it?

A Yes.

MR. STEER: Available if you can get it out.

Q MR. FENERTY: Now you are talking about available. Dr. Hume said gas was available. Now, look, are you talking about a gas that is available in this thing or just something that is there that you can not get?

A It is gas in the reservoir, it is gas in place. That is our common way of speaking about it.

Q I am wasting time, I know, but I am suggesting to you that there is only one possible interpretation. When you say

you have so much gas in place which is available at 14.4, what do you mean? I am just puzzled. Available with 14.4, now what does it mean and I will stop.

A Well, I thought I had tried to answer it.

MR. C.E. SMITH: I hesitate to do this but here is this book you have been hollering for.

MR. FENERTY: Of course, the book doesn't mean anything now on that theory. All right, I am sorry I took up the time.

EXAMINATION BY MR. C.E. SMITH:

Q Hawthorn, you will be glad to know that I believe that whether you or anybody else takes an oath here he conscientiously gives us the very best information, and that includes everybody.

A Thank you.

Q Before I forget, you referred, I think, to what you called a conditional export permit and I know there was some evidence given before by Mr. Lewis?

A Yes, Mr. Lewis presented that to the Board.

Q If I can get it in a nut-shell, would you give me an illustration having regard to this Board of a conditional export permit? Do you follow me? Could you illustrate it with respect to any applicant?

A I might go so far as to say the conditions under which the Federal Power Commission, which Mr. Lewis used as an example, gives conditional certificates, and Mr. Lewis and I discussed this before I left Houston, and he, the week before that, had an opportunity to talk with Mr.

Hammer, who is in the consulting business now, and has just left after years of employment with the Federal Power Commission, and Mr. Lewis learns from Mr. Hammer that the Federal Power Commission grants conditional certificates on these basic conditions: the number one condition is that the applicant has a meritorious case, it is a case that has enough virtue and enough merit that they would like to see a permit granted and the project go forward.

(Go to page 656)

Q Yes?

A But if for one reason or another the project is not entirely firmed up with contracts, or the numerous other things that are required, then if there are no other parties in the case which will receive detrimental treatment, then the Federal Power Commission will, after reviewing the type of shortcomings that the applicant has, they call them deficiencies, they will grant them a deficiency letter or a deficiency application, reiterating what the deficiencies are, and, if they are not too serious and they are firmly convinced that they can be cured, then the Federal Power Commission will issue this conditional certificate.

Q Well, all that means, as I understand it, Mr. Hawthorn, is that the Federal Power Commission says to the applicant, if there is only one, and nobody fighting very hard, "Go away and get me proof of this thing and the other thing and then come back, and then we will probably give you your permit if you can establish what is presently missing", is that the idea?

A That is it in substance, yes. And I will grant you it is somewhat the aspect of the contract, that is, to make ifs and ands, and to make qualifications to it where the contract is not just so.

Q Yes, but really.....

A Our thinking was, as I expressed it a few minutes ago, that either a conditional certificate or any other type of.....

Q What was the other expression you used, deficiency letter?

A Yes, deficiency letter.....

Q Yes?

A ....could be granted that would assure the operators, give the assurance that is needed to the operators that would be helpful in getting these probable gas reserves proved up.

Q I will go further. Take what is before this Board now with respect to all the applicants, in your opinion, as presently advised, this Board might give them deficiency letters, as you call them, or they might not, - I say only might - the Board may suggest "Come back at a later date and if we have got a little more proof with regard to this, that and the other thing," is that it in a nutshell?

A Well, I think the finalizing of that thing is certainly entirely up to the Board. We are just making a casual suggestion that we hope will be helpful to them.

Q Quite. I see.

A In the way that we handle some of the cases.

Q All I was getting at was the word "conditional export permit". When you suggest that the Federal Power Commission does it, it is not quite that, it is more of an adjournment to give them an opportunity to prove something in the future, is that right?

A I presume that is the substance of it.

Q Will you refer to J-22, Mr. Hawthorn? I will try to be as short as I can, but I have a few pages turned down here. And at the bottom of your first place, if I understand your last paragraph of that page correctly, it is your opinion that possibly with the exception of McColl, all applicants here will need a Provincial-wide

grid system to perform the business for which they are applying is that, generally speaking, true? In other words, do you think that a grid system is necessary to get in connection with the protection for the Province and export combined? That is what I gathered from that, anyway.

A I do not know that I would go so far as to say that it is entirely necessary, but the virtues and the merits of it have been reviewed to considerable length.

Q Yes?

A And we concur in the merits of the grid system.

Q Well, that will suit me. Now, referring to the top of Page 2, Mr. Hawthorn.....

A Yes?

Q .....you have set out presently planned market requirements for substantially 20 years, and these are as follows:- that is, to meet the Western's requirements, - Pincher Creek, Pendant d'Oreille, or whatever Mr. What's-his-name calls it, Manyberries, Princess-Patricia, Black Butte, Smith Coulee and Turin.

A Yes.

Q Now, assuming that Pendant d'Oreille, Manyberries and Smith Coulee are, as we understand, owned and controlled by McColl, who are also applying for a permit, what have you to say with respect to Princess-Patricia being, as some of them have said, I think it was Dr. Beach, beyond economic reach Do you think that you could still use that field, and it may not be beyond economic reach for Western's plans?

A Well, it would entirely depend on the course of the line,

the route of the line, but the route of the line, as I have mentioned here, might run northeast, I believe, between Pendant d'Oreille and Princess, and will serve the whole area.

Q You mean if you do not get Pendant d'Oreille you might run it far enough north to pick up Princess-Patricia, is that what you have in mind?

A No. I mean that it would be a route well worth considering. This is different than the original plan as presented by Western, but I do not think any plans are entirely finalized yet. Certainly, it is in the final course of the run, of the line, and the line could well run in a northeasterly direction, and passing through the heart of the productive area of Southern Alberta.

Q Let me put this to you, if you were to omit what I will call the McColl-Frontenac controlled areas, Western, as present planned, would be entirely or almost entirely dependent on Pincher Creek, is that a fair way of putting it?

A I think so, yes, sir.

Q Now, going to Pendant d'Oreille, or to Pincher Creek, I am sorry, you say at the bottom of Page 2, "Factual data and interpretations have been furnished by Canadian Gulf Oil Company", and then you go on to give some data. Have you had an opportunity of studying the figures on Page 3 and come to your own conclusions with respect to those figures, or are they just taken from what Gulf gave you, the areal extent and so on?

A We have examined all of the material and have Gulf Canadian's report on Pincher Creek. We have all the material

that they have prepared with the exception of the geophysical material which is, of course, the backbone of the structural map.

Q You have actually studied these things yourself?

A Yes.

Q And you are in agreement as to their conclusions with respect to the thickness, prosity, connate water and so on? Is that a fair way of putting it?

A Substantially so, to the effect that we have had the mass of detailed data that goes behind these figures.

Q Now, other people have done the same thing, I gather from their evidence, and I have before me the submission that is to be submitted by Prairie, and it is already distributed, the submission of Mr. Galloway, and, if I understand him correctly, he got the same material from Gulf as you did, and he gives us his estimated marketable reserve of 1 trillion 700 billion compared with your 1 trillion, 248 billion. Can you explain to me and other laymen like Mr.Fenerty, how two such experts, or three such experts, can get so far apart and apparently using the same data, approximately 500 billion?

A Are you sure that is qualified as reserves that are marketable?

Q Have you read it, or maybe you have not seen it?

A No, sir, I have not seen it.

Q I may be wrong with regard to that, and if so, some gentleman no doubt will correct me?

A Here we have ended up with the four final figures, and if those four final figures are not carefully qualified, they can be, well, misleading.

Q Well, your estimated marketable gas is 1 trillion 248 billion, is that correct?

A Yes.

Q I am reading from Page 9 of the submission by John O. Galloway, the one that has not been presented yet, but has been distributed, and reading from Page 9 he gives the total marketable gas as 1 trillion 700 billion. So that you must be talking about the same thing. Do you want to see his?

A Well, if you would like me to look at it.

Q I thought probably you would have one in front of you?

A No, I haven't had one.

Q All I was wondering about, and I am not being critical, about either you or Mr.Galloway, but you were both taking the same data from the same source, and it seems to me that we should get a little closer together, that is all, and I wonder if you could explain why not?

A Well, his figures are not the figures ttat have been presented to us by Gulf.

Q Not the figures presented to you by Gulf?

A No, sir.

Q Probably you could tell us wherein they differ then?

A Well, there is a vast difference in the acreage.

Q Yes. His acreage is, or your acreage is 17,250, and his is what?

A 11,680.

Q Do you mean he has less than you?

A Yes.

Q He has to gain a lot somewhere else. Go ahead?

A The thickness is 540 feet against....

Q Yours is 394?

A Yes, mine is 394.

Q And that would make a great difference, wouldn't it?

A Yes.

Q Five thousand and what?

A 540 against 394.

Q O.K.

A The porosity is 4.3 as against 2.6.

Q Yes. He gains on you there. And the connate water?

A The connate water is the same.

Q The pressure?

A The pressure is the same.

Q Yes?

A The temperature is the same.

Q Anything else that you notice at the moment, Mr. Hawthorn?

A Well, from a quick look, no.

Q I suppose the thickness and porosity, the difference might account for the whole thing, may it, and then there is much less acreage?

A The acreage is much less and the porosity is much more and the thickness is much more, and he has not shown some factors here that I would have to see in order to get a proper comparison there.

Q In any event, is this true, that your figures are taken directly from information given to you by Gulf?

A That is correct.

Q Is that correct?

A Yes, that is correct. We certainly have not had the material to delve into the problem, and in any way to

take exception to what Gulf has prepared. In our opinion, Gulf has done a very excellent job in the estimation of their figures.

Q You would expect Gulf to supply the same figures that you have on Page 3?

A Yes.

Q You would expect that?

A Yes, I would.

Q All right, that is fine. Now, I am not going to deal with all of the fields, although I had them all marked down. If you will look at Page 5, for instance, and you are dealing with the Pendant d'Oreille field there, and you have estimated the marketable gas at 226.3 billion. You have seen, I take it, Dr. Beach's report, or have you been able to see it since?

A I just had a moment to glance at it, but his figure is more than this.

Q 257.3?

A Yes, sir.

Q Now, both of you, as I understand it, hope to use the Pendant d'Oreille field? That is, both applicants? When I say "both of you" I mean both Western and McColl-Frontenac?

A Yes.

Q Is there anything you can say by way of explanation as to the difference between your figure and Dr. Beach's, for instance. Is it Dr. Beach?

A Yes.

Q Yes?

A Dr. Beach uses a larger areal extent of the field than we have used, and I think he has some material in his

files that would justify that that we have not had.

Q In fairness, probably it is true that Dr. Beach has paid what I might call very particular attention to the Pendant d'Oreille field?

A Yes.

Q On behalf of McColl-Frontenac?

A Yes.

Q I take it you do not want to change your figures because of what you have learned since Dr. Beach gave his estimates?

A No, sir, I would not have any material to base it on.

Q And does that apply to the rest of it? For instance, Manyberries, you have 35.6 and Beach, 100.5?

A I have explained that, Mr. Smith. I think this new well drilled this last summer - I am sure the reason for Dr. Beach enlarging his original figure by so much is this well which was completed last summer has presumably enlarged the field materially. We have not had the information on that well.

Q That would hardly apply to the Princess area, would it? There is nothing new there?

A No, sir.

Q Yet you have 145 against his 325?

A Yes, sir. There are wide differences of opinion on Princess.

Q We have discovered that. That is quite true. But is there anything in particular you would like to draw to the Board's attention with respect to such differences? That is what I want to get at.

A No, I believe not, Mr. Smith.

Q Black Butte is in the same category. You are 4.2 and he is 30.4?

A No, sir.

Q Smith Coulee I take it - -

A Just one minute on Black Butte. We total 25 against his 31, is it not?

Q I beg pardon. There you add up the last three figures.

A I am sorry I did not put the cumulative there of the three sands.

Q You are not far apart. You are 25 and he is 30. Smith Coulee, where he is 1.8 and you have 5.6. That could be due to the new discovery?

A To the new well completed last summer.

Q As I said before both you gentlemen are giving estimates on behalf of applicants who are in the main expecting, or hoping maybe is a better word, to get supplies for your various systems from the same fields?

A Yes.

Q There is nothing more you can add to help us in the differences? I will not go any further with J-22. Will you look at J-23 for a moment? Going to the bottom of page 3 and the top of page 4, when you deal there with the anticipated possible Pincher Creek plant. You say at the bottom of the page:

> "The Pincher Creek plant would have to be designed to handle about 250 million cubic feet of raw gas per day."

That would leave approximately what, 200 or 190 feet available to the pipe lines. Would that be roughly it? Somewhere around 80%?

A Yes, sir.

Q I take it that if that were the situation even at 200 Western would take, would have to take practically all of Pincher Creek to fulfil the plans that they have in mind?

A Oh, yes.

Q Above that plant - -

A Yes, it will require all Pincher Creek.

Q And so much more so if they are only delivering 145 million feet a day as you refer to in the second paragraph?

A The difference between the two, Mr. Smith, is that in this first case Pincher Creek is designed to throw the gas up and down with the load requirements, where in the second case it is held constant.

Q At 145 million?

A Yes.

Q You would need a little more than that?

A Yes, in both cases that shows a deficiency.

Q I take it no matter what occurs in respect to Pincher Creek we would say that Western could require practically the whole of the pipe line gas available from Pincher Creek?

A Yes.

Q That is true?

A Yes, sir.

Q I suppose your client is prepared to do battle with Prairie and a few other people in that respect. Now looking at 24 for a moment, at page 3, about 2/3 of the way down

to the bottom of the page:

"Mr. Davis has estimated that 75 billion - - -

A Yes, sir.

Q "- - of additional gas reserves will have to be added to Canadian Western system to meet 1960 requirements fully."

and so on.

"It would seem that the only way to lessen this deficiency in gas delivered from the fields would be for Jumping Pound to ultimately show a larger reserve than has been estimated."

Do you mean there than has been estimated by Mr. Davis?

A Yes, that is the inference.

Q In other words, if the reserve estimated by Dr. Nauss were found to be the more correct, we would have to almost double Mr. Davis, if I remember correctly?

A That is correct.

Q Would you then say that might be a possibility which would affect the deficiency stated by Mr. Davis?

A That was the thing which I wished to bring out there, yes.

Q You also, I think, indicated insofar as Canadian Western deficiencies may be concerned, that presently your thought is that some or a lot of it should be in some way even be brought from what we call the North? Did I understand you correctly?

A That is my thinking on it, yes, sir.

Q Which I take it would mean a connection between Red Deer and Calgary on what I call their connected pipe line, to start with?

A That is what I suggest.

Q And where would you get that, from places like Morinville or what have you in mind?

A Places like Morinville and particularly flared gas that is going - it definitely appears you are going to have a whole flock of oil fields up there in that area.

Q Can you tell me which is a good one to buy?

A And that should be taken care of instead of flaring the gas.

Q You have that in mind?

A Yes.

Q And you have Morinville in mind as a regular gas field, is that the idea?

A Yes, and from numerous places in that area. There are numerous fields now and there will be more numerous ones throughout.

Q I suppose your client would not like us to take the Pendant d'Oreille to supply the deficiencies in the Canadian Western system?

A They could do it, as I have said here, but those are dry gas fields with high pressure and more suitable to high pressure lines.

Q Now turning to page 6. I am trying to miss a lot of stuff here. You are talking about the Leduc gas/oil ratio and gas/oil production.

"In estimating the amounts of gas to be available from Leduc, we have assumed an increase in gas/oil ratio and gas production of 2 to 1 over the next

"10 years. Thereafter we have considered the available gas to remain constant. This is believed to be conservative since it is entirely possible for the gas/oil ratio to increase more in the order of 3 or 4 to 1."

Over the next 10 years, is that your opinion with respect to the rise in the gas oil ratio in Leduc?

A That is the assumption I have made on the very little intimate knowledge of the field.

Q Have you heard the discussion of the last two days?

A Yes, sir, with great interest.

Q Have you changed your opinion at all?

A No, sir.

Q From what you have heard?

A No. As far as I can tell, the testimony that Mr. Pot gave this morning substantiates the statement I have made here as reasonably as can be expected.

Q And have you in mind the idea that all of the gas produced at Leduc shall be available to Northwestern Utilities or could be available for their protection? I refer to the bottom of page 6. You mention it there.

A Where I say - -

MR. FENERTY: What do you mean by "available"?

MR. C.E. SMITH: So I can reach out and grab it, like that.

A I have lost the question now, Mr. Smith.

Q MR. C. E. SMITH: I say in your opinion should the whole of Leduc, whatever gas is produced from Leduc,

marketable gas, be available to Northwestern for the proper protection of the Province.

A Well it certainly is an ideal gas reserve and ideally situated for that use.

Q Do you think it should be so considered then, put it that way?

A I do not know that I have any definite opinion on that.

Q Let me go one step further. Do you think there should be any export gas from the Leduc-Woodbend field?

A Well the years might tell that there would be.

Q That does not help me much. Do you think there can be?

A Yes, sir, it could be.

Q Do you expect it?

A I think the complications of what will become of that gas and all the rest of the oil wells gas down through the years is too complicated a prediction to make. I think there will be a lot of intermingling of gases up in that country in the years to come.

Q Maybe we will have a grid system, is that what you mean?

A Maybe we will.

Q Now, coming to the two charts on page 24, I take it these are prepared in accordance with Mr. Davis' figures and calculations, is that correct, for both Canadian Western and Northwestern?

A Those are my calculations, Mr. Smith.

Q From those figures supplied by Mr. Davis, are they not?

A They are based on the requirements as presented by Mr. Brownie and Mr. Davis' reserve estimates. But the deliverability studies are our figures.

Q That is what I am getting at. Mr. Brownie's as to requirements, Mr. Davis' estimates as to reserves?

A Yes.

Q And deficiencies?

A Yes. That long line labelled "Estimated Requirements" are the figures presented by Mr. Brownie. All the other material on there is the material we have developed on the basis of Mr. Davis' reserve estimate.

Q For instance, your deficiency figure here, is that the same deficiency he had?

A No, sir.

Q He had about 254 and in order to get that he needed 750 gross, something like that?

A Yes, I will concur in that because this is only a volume deficiency and does not provide for reserve in the ground to provide for deliverability at the end of the 30 years.

Q I think Mr. McDonald dealt with the Turin well in 25. I think probably that is all, Mr. Hawthorn.

THE CHAIRMAN: We will adjourn until tomorrow morning.

MR. STEER: Mr. Chairman, is there any indication whether or not we will be sitting Friday?

THE CHAIRMAN: As far as I know at this time, I do not think it is possible for us to sit on Friday. If we can make other arrangements, we will, but at the present time I do not think it is possible for the Board to sit.

(At this stage the Hearing was adjourned until 9.30 A.M. November 8th , 1950.)